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PROGRAM MANAGER, A.F.D.S.E.  
LT COL CLAUDE CAVENDISH

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SUBMITTED TO  
AIR FORCE OFFICE OF SCIENTIFIC RESEARCH  
WALLING AIR FORCE BASE  
WASHINGTON, DC  
DECEMBER 1980

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UNITED STATES AIR FORCE  
GRADUATE STUDENT RESEARCH PROGRAM  
1988  
PROGRAM MANAGEMENT REPORT  
UNIVERSAL ENERGY SYSTEMS, INC.

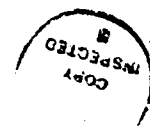
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Susan K. Espy

Submitted to  
Air Force Office of Scientific Research  
Bolling Air Force Base  
Washington, DC

December 1988



Approved	
Disapproved	
Reviewed	
Not Reviewed	
By	
Date	
DM	
A-1	

The United States Air Force Graduate Student Research Program (USAF-GSRP) is conducted under the United States Air Force Summer Faculty Research Program. The program provides funds for selected graduate students to work at an appropriate Air Force Facility with a supervising professor who holds a concurrent Summer Faculty Research Program appointment or with a supervising Air Force Engineer/Scientist. This is accomplished by the students being selected on a nationally advertised competitive basis for a ten-week assignment during the summer intersession period to perform research at Air Force laboratories/centers. Each assignment is in a subject area and at an Air Force facility mutually agreed upon by the students and the Air Force. In addition to compensation, travel and cost of living allowances are also paid. The USAF-GSRP is sponsored by the Air Force Office of Scientific Research, Air Force Systems Command, United States Air Force, and is conducted by Universal Energy Systems, Inc.

The specific objectives of the 1988 USAF-GSRP are:

- (1) To provide a productive means for the graduate students to participate in research at the Air Force Laboratories/Centers;
- (2) To stimulate continuing professional association among the Graduate Students and their professional peers in the Air Force;
- (3) To further the research objectives of the United States Air Force;
- (4) To enhance the research productivity and capabilities of the graduate students especially as these relate to Air Force technical interests. *Keener of Air Force research interests.*

During the summer of 1988, 107 graduate students participated. These researchers were assigned to 23 USAF laboratories/centers across the country. This three volume document is a compilation of the final reports written by the assigned students members about their summer research efforts.

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## I. INTRODUCTION

Universal Energy Systems, Inc. (UES) was awarded the United States Air Force Summer Faculty Research Program on August 15, 1984. The contract is funded under the Air Force Systems Command by the Air Force Office of Scientific Research.

The program has been in existence since 1978 and has been conducted by several different contractors. The success of the program is evident from its history of expansion since 1978.

The Graduate Student Research Program (GSRP) is conducted as part of the Summer Faculty Research Program (SFRP).

The program provides opportunities for research in the physical sciences, engineering, and life sciences. The program has been effective in providing basic research opportunities to the Graduate Students of universities, colleges, and technical institutions throughout the United States.

The program is available to Graduate Students enrolled in either Masters Degree or Doctorate Programs. It has proven especially beneficial to the students who are starting their academic research programs.

When the GSRP was first started, the graduate students were selected along with their professors to work on the program. A pilot program for Graduate Student Summer Research via the AFOSR Summer Faculty Research Program (SFRP) was initiated in 1982. The program was developed as an adjunct effort to the SFRP. Its purpose was to provide funds for selected graduate students to work at appropriate Air Force laboratories or centers with supervising professors who hold concurrent SFRP appointments.

Starting with the 1985 GSRP and again for the 1988 GSRP, emphasis was placed on selecting graduate students to be placed with either supervising professors on the SFRP or with the Air Force laboratory/center engineers/scientists. In 1988 there were 182 GSRP applicants. A total of 107 graduate students were selected to participate in the 1988 program. Since the initiation of the program in 1983, the program has expanded from 17 graduate students in 1983 to 107 in 1988. Table 1 lists the number of GSRP participants and demonstrates the growth of the program.

Year	Number of graduate students
1982	17
1983	53
1984	84
1985	92
1986	100
1987	101
1988	107

Table 1 GSRP Participation Statistics

## II. RECRUITING AND SELECTION

The program is conducted on a nationally advertised and competitive selection basis. Advertising for the 1988 program was conducted via direct mail to all accredited schools. The mailing was sent to the department chairman at the schools. The departments included biology, genetics, ecology, entomology, chemistry, computer science, graphics, mathematics, physics, aeronautical engineering, ceramic engineering, chemical engineering, materials science, mechanical engineering, electrical engineering, metallurgy, nuclear science, and psychology. The brochures were also mailed to all of the participants in the 1985 and 1986, and 1987 SFRP and GSRP. Brochures were mailed to the Presidents of Historically Black Colleges. The brochures were sent to all participating USAF laboratories/centers; distribution was made through AFOTC units on university campuses; information was supplied to all who made requests. Overall, more than 17,000 brochures were distributed throughout the country.

Application deadline for the GSRP was April 1, 1988. The announcements of selections were mailed on April 15, 1988.

The 1988 SFRP is published as five separate documents. The reports are entitled Summer Faculty Research Program Management Report and Technical Reports, Volume I, II, III and IV.

## III. SITE VISITS

Visits listed below include those by UES and AFOSR personnel. The faculty, USAF research colleagues, and student participants are generally satisfied with the program. Criticisms were: a) too much paper work to administer program, b) housing difficult to find, c) 10 weeks too short for research period.

June 20, 1988	School of Aerospace Medicine HRL: Training Systems Division HRL: Manpower and Personnel Division Occupational and Environment Health Laboratory Brooks Air Force Base, Texas
June 21, 1988	Armament Laboratory Eglin Air Force Base, Florida
June 22, 1988	Engineering and Services Center Tyndall Air Force Base, Florida
June 23, 1988	Eastern Space and Missile Center Patrick Air Force Base, Florida
June 28, 1988	Arnold Engineering Development Center Arnold Air Force Base, Tennessee
June 29-30, 1988	Wright-Patterson Air Force Base Dayton, Ohio
July 7, 1988	Rome Air Development Center Griffiss Air Force Base, New York
July 8, 1988	Electronics Systems Division Geophysics Laboratory Hanscom Air Force Base, Massachusetts
July 19, 1988	Astronautics Laboratory Edwards Air Force Base, California
July 20, 1988	HRL: Operations Training Division Williams Air Force Base, Arizona
July 21, 1988	Weapons Laboratory Kirtland Air Force Base, New Mexico
July 22, 1988	Frank J. Seiler Research Laboratory United States Air Force Academy, Colorado

Because of the proximity of UES to Wright-Patterson Air Force Base, several site visits were made to the following laboratories:

Aero Propulsion Laboratory  
Armstrong Aerospace Medical Research Laboratory  
Avionics Laboratory  
Flight Dynamics Laboratory  
Human Resources Laboratory  
Materials Laboratory  
Wright-Patterson Air Force Base, Ohio

We find that the objectives of the GSRP are being well served. Summer Fellows indicate that they are performing independent research, and are not being used as "summer help". We have found no abuse of the non-personal services requirements. Research fellows often conduct lectures and seminars at the Air Force locations.

As a record of the documentation supplied to the appointees, the UES Information and Appointment Packets are provided in Appendix I of this report.

#### IV. HISTORICALLY BLACK COLLEGES/UNIVERSITIES (HBCU's)

In support of with the Summer Faculty Research Program, and as part of the UES EEO/Affirmative Action Program, UES sponsored an information booth at the NAFEO (National Association for Equal Opportunity in Higher Education) Conference. The conference was held on March 23 through 27, 1988. UES provided information on the UES-AFOSR summer programs at this conference.

UES visited various Historical Black Colleges and Universities throughout the country. During these visits faculty and administrators were briefed on the benefits and research opportunities of the SFRP. The targeted groups within the University community were faculty of the Engineering, Physics, Mathematics, Life Sciences, Physical Sciences, and Computer Sciences Departments.

The objectives of the visits are to encourage administration support and faculty participation. The program's reception at each institution was very good.

Because of the contract starting date and the Program Office desires in scheduling, the 1987-88 visitation schedule was decreased by 18% from 1986 schedule. Below is a summary of universities that were visited and the date:

##### NOVEMBER 1987

Wilberforce University, Wilberforce, OH	November 16
Central State University, Wilberforce, OH	November 17
Philander Smith College, Little Rock, AR	November 18
Arkansas Baptist College, Little Rock, AR	November 18
University of Arkansas, Pine Bluff, AR	November 19
Alabama A&M University, Huntsville, AL	November 23
Talladega College, Talladega, AL	November 23
Tuskegee University, Tuskegee, AL	November 24
Alabama State University, Montgomery, AL	November 25

##### DECEMBER 1987

Bowie State College, Bowie, MD	December 1
College of the Virgin Islands, VI	December 3, 4, 5
North Carolina Central, Durham, NC	December 8
Fayetteville State Univ., Fayetteville, NC	December 9
North Carolina A&T University, Greensboro, NC	December 10, 11

# JANUARY 1988

LeMoyne Owen College, Memphis, TN	January 12
Jackson State University, Jackson, MS	January 13
Tougaloo College, Tougaloo, MS	January 13
Southern University, Baton Rouge, LA	January 14
Dillard University, New Orleans, LA	January 15
Xavier University, New Orleans, LA	January 15
Texas Southern University, Houston, TX	January 19
Prairie View University, Prairie View, TX	January 19
University of Puerto Rico, Mayaguez, PR	January 21
University of Puerto Rico, San Juan, PR	January 22

The following statistics are presented as a demonstration of the success of the HBCU workshops. The number and quality of the HBCU applicants for the SFRP, GSRP, and Research Initiation Program speak for the success of this effort. UES does not have any data prior to the 1985 program year to include in this analysis.

YEAR	Number of HBCU SFRP Applicants	Number of HBCU GSRP Applicants	Number of HBCU RIP Applicants
1985	76	15	10
1986	70	20	16
1987	82	32	23
1988	53	23	N/A

YEAR	Number of HBCU on SFRP	Number of HBCU on GSRP	Number of HBCU on RIP
1985	23	11	7
1986	18	10	10
1987	18	10	7
1988	18	14	N/A

Table 2 HBCU Participation

## APPENDIX I

This appendix presents the following documents which were distributed to appointees and other program participants.

- A. Information Brochure for Summer Fellows.
- B. Questionnaire for participants and a summary of their replies.
- C. Questionnaire for Air Force laboratory representative and a summary of their responses.
- D. Questionnaire for Research Colleague and a summary of their replies.

APPENDIX 1.A

INFORMATION BROCHURE

for

SUMMER FELLOWS

on the

1988 USAF-UES GRADUATE STUDENT RESEARCH PROGRAM

March 1988

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## I. SUMMER FELLOW OBLIGATIONS

Universal Energy Systems, Inc. (UES) is required by contract to impose certain obligations on you in your status as a Summer Fellow. This section outlines those obligations, and you should read them thoroughly. You are required to sign and return the statement of understanding before the final processing of your appointment can be completed. The following is a list.

1. Research Goals and Objectives: A statement of research objectives must be provided to UES PRIOR TO the start of the summer research period. It should outline your goals and the approach you intend to follow in researching these goals. Neither travel expenses nor expense allowances will be reimbursed until after receipt of your statement of research objectives. The report should also clearly indicate the date of your first working day of the summer research period. If you are working with a professor during the appointment, the goals and objectives may be the same as submitted by the professor.
2. Final Report: At the end of your summer research effort, you are required to submit to UES a completed, typewritten scientific report stating the objectives of the research effort, the approach taken, results, and recommendations. Information on the required report format will be sent to you with a "FINAL REPORT INFORMATION BULLETIN" and sample report illustrating a suggested format. The final report must first be approved by your Effort Focal Point and then transmitted so as to reach UES by Friday, September 30, 1988. Payment of "Compensation" for the final two weeks of your ten-week research period cannot be made until UES has received and approved this report in the required format.
3. Program Evaluation Questionnaire: You will be sent a critique form to complete near the end of your research period regarding your impressions of the program. This critique form should be completed and returned to UES, along with your final report, by Friday, September 30, 1988. The return of this form is a program requirement; it also must be received by UES before the final compensation payment can be made.
4. U.S. Air Force - Summer Fellow Relationship: The U.S. Air Force and UES understand and agree that the services to be delivered by Summer Fellows under this contract will be non-personal services and the parties recognize and agree that no employer-employee or master-servant relationships will exist between the U.S. Air Force and the Summer Fellows. Non-personal services are defined as work performed by an individual who is responsible for an end item, such as a report, free of supervision of the U.S. Air Force and free of an employer-employee relationship.

As a Summer Fellow, you will not:

- (a) Be placed in a position where you are appointed or employed by a Federal Officer or are under the supervision, direction, or evaluation of a Federal Officer, military or civilian.
- (b) Be placed in a staff or policy-making position.
- (c) Be placed in a position of command, supervision, administration, or control over Air Force military or civilian personnel or personnel of other contractors or become a part of the U.S. Air Force organization.

The services to be performed under the GSRP do not require UES or the Summer Fellow to exercise personal judgement and discretion on behalf of the U.S. Air Force; rather, the Summer Fellows will act and exercise personal judgement and discretion on their research programs on the GSRP conducted by UES.

The Air Force will have unrestricted use of and access to all data developed during the period of this appointment.

## II. ALLOWABLE TRAVEL EXPENSES

If you live outside of the area (50 miles) where you will be assigned for the summer program, the GSRP provides potential funding for the trip between your home and your assigned research location. As soon as you have signed and returned your appointment letter along with the budget sheet, you will be authorized to receive reimbursement for travel expenses as described below.

You are expected to make your own arrangements for this trip, and after the trip you may invoice UES for reimbursement of allowable expenses in the format described in the Instructions for Invoicing for Compensation and Reimbursement section of this brochure. Closely coordinate your travel plans with your EFFORT FOCAL POINT or your supervising professor.

All travel reimbursements under Summer Fellow appointments are made according to current UES policy, and deviations from the approved budget are not authorized and will not be reimbursed. In light of these restrictions, you may choose either to travel by common carrier at coach rates or less, by driving your private auto, or by a combination of both. With any of these choices you may claim reimbursement up to the amount for the most direct routing, taking into the account the desirability of routing on interstate highways if you drive your private auto.

Reimbursement for direct route travel by common carrier will be paid on your submission of an invoice to UES following the invoicing instructions referenced above. In the view of the convenience of having a car at the research location, UES strongly recommends that a private auto be used for travel when practical. Reimbursement when you drive your private auto is at the rate of 20¢ per mile within the above routing restrictions and will be paid on submission of a suitably prepared invoice. These reimbursements cannot be extended to cover travel by your family if they accompany you on either of these authorized trips.

During the ten week summer research period, you will be authorized to receive an expense allowance in lieu of a per diem payment at a rate of \$30 per day for a maximum of 70 days. To receive this allowance, you must invoice for it and be living (50 miles) outside your area of residence.

These items above are the only reimbursable travel allowances authorized under the GSRP appointment. Any additional travel expenses incurred during the appointment period will be your personal responsibility.

UES has arranged with a travel office in Dayton, Ohio, to have the air fare costs of your travel on the GSRP charged directly to UES. For you to take advantage of this, you must call this travel service. The number in Dayton, Ohio, is (513) 293-7444 or 1-800-628-6668. You must give the code SLI3 to have the tickets charged to UES.

If you require a cash advance for the start of the program, please indicate the amount on the bottom of your budget sheet. The cash advance will be deducted from payments of your bills of service.

### III. INSTRUCTIONS FOR INVOICING FOR COMPENSATION AND REIMBURSEMENT

Attached is a copy of the Invoice Format that you are required to use to obtain compensation or reimbursement from UES. Note that all disbursements by UES for compensation, travel, and/or other expenses are subject to audit approval, so you must submit receipts substantiating charges invoiced.

In addition, you must prepare, sign, date and attach to each completed invoice a Brief Report of Effort

#### A. PREPARATION OF BRIEF REPORT OF EFFORT

Whenever you submit an Invoice for reimbursement to UES you must also include a brief report describing your activities for the invoice period. To meet this obligation, you must prepare, date, sign, and attach to your completed invoice a Brief Report of Effort describing the research accomplished on the appointment and explain any travel during the invoice period.

This report should describe innovative techniques and designs or discoveries which may be disclosed as patents. Rights to any inventions or discoveries shall reside with UES unless determined otherwise by the contracting agency.

The Brief report should never exceed one typewritten page and most often should be considerably shorter than one page.

#### B. PREPARATION OF INVOICE FORMAT

The financial items required on the Invoice Format are for COMPENSATION, TRAVEL, EXPENSE ALLOWANCE, AND PER DIEM.

##### Item (1) SOCIAL SECURITY/MAILING ADDRESS

Fill in your name, social security number, and address to which you wish to have your check mailed.

##### Item (2) COMPENSATION

(a) Indicate the dates for which you are claiming compensation, and indicate the number of days you are claiming for compensation.

(b) Multiply this number by \$66.00 for B.S. degree holders and enter the total dollar amount in the blank total charges for service. The accumulated total number of days you claim on this appointment may not exceed the number authorized in your appointment letter.

Item (3)     TRAVEL

- (a) Under the heading Date indicate the date you departed on your trip and the date you arrived at your destination. If you are invoicing for a round trip, also list the date you departed on your trip and the date you arrived home.
- (b) Under the heading Dept/Arrival Time list the departure and arrival times for the corresponding days you listed under Date.
- (c) List your destination under the heading Destination.
- (d) Under the heading Mode, indicate your principal means of conveyance; i.e., commercial air, private auto, etc
- (e) Under the heading Amount, itemized these expenditures for travel reimbursement. Continue them on a separate sheet if necessary.
- (f) Total these travel items and enter the dollar amount for travel in this invoice on the line to the right of Total Travel Expense.

Item (4)     EXPENSE ALLOWANCE

This item on the invoice will be used to claim the \$30 per day for reimbursement of costs incurred at your assigned research location.

- (a) In the first blank to the right of EXPENSE ALLOWANCE enter the number of days for which you are claiming the expense allowance at your assigned research location.
- (b) Multiply this number by the daily allowance rate of \$30.00 and enter this total dollar amount in the blank at the far right.
- (c) Itemize the days for which you are claiming the Expense allowance reimbursement. It can include weekend days and holidays as well as regular work days.

Item (5)     PER DIEM

This item is not applicable to the GSRP.

Item (6)     INSTRUCTIONS

You may combine reimbursement requests for compensation, travel, and Per diem or expense allowance in the same invoice. The total for all items invoiced should be indicated on the blank on the right hand side of line 7.

If you have arranged your travel through the UES travel office as described on page 4, please indicate the cost of the tickets on this line.

**IMPORTANT:** Indicate in the space provide on each invoice the address to which you want the check mailed.

You must sign and date your invoice in the lower left hand corner as "Summer Fellow" before it is submitted; you **MUST** also have your Effort Focal Point countersign the invoice before it is mailed to UES Your Effort Focal Point is an Air Force individual at your research location who will be identified prior to your effort start date.

Invoices should be mailed to:

Universal Energy Systems, Inc.  
GSRP Office  
4401 Dayton-Xenia Road  
Dayton, Ohio 45432

IV  
BILL FOR SERVICE

1. \_\_\_\_\_  
Name (First, Initial, Last) Social Security # \_\_\_\_\_  
\_\_\_\_\_  
Address (Street, City, Zip)  
SERVICE: GSRP Summer Fellow  
SERVICE AUTHORIZED BY: Rodney C. Darrah  
RATE AUTHORIZED: \$66.00/day for B.S. Degree  
This service is for:  
Government Contract: Project # 210  
Government Contract No. F49620-88-C-0053
2. DATES OF SERVICE: \_\_\_\_\_ TOTAL DAYS OF SERVICE \_\_\_\_\_  
TOTAL CHARGES FOR SERVICE: \_\_\_\_\_  
ADDITIONAL ITEMIZED REIMBURSABLE EXPENSES:  
(receipts required for expenditures over \$25.00)
3. TRAVEL: DATE \_\_\_\_\_ DEPT/ARRIVAL TIME \_\_\_\_\_  
DESTINATION \_\_\_\_\_ MODE \_\_\_\_\_ AMOUNT \_\_\_\_\_
4. EXPENSE ALLOWANCE: ( \_\_\_\_\_ days at \$30.00/day) \$ \_\_\_\_\_
5. PER DIEM: (Not Applicable)
6. TOTAL AMOUNT OF BILL: \_\_\_\_\_
7. AIR FARE TICKETS CHARGED DIRECTLY TO UES. AMOUNT: \$ \_\_\_\_\_

\_\_\_\_\_  
Summer Fellow Signature - Date Telephone \_\_\_\_\_

Invoice Approval: \_\_\_\_\_  
Effort Focal Point Signature

X \_\_\_\_\_ Brief Report of Effort  
Type or Print Name Attached \_\_\_\_\_

Location: \_\_\_\_\_

Telephone: \_\_\_\_\_ Date: \_\_\_\_\_

Send bill to:  
UNIVERSAL ENERGY SYSTEMS, INC.  
ATTN: GSRP Office  
4401 Dayton-Xenia Road  
Dayton, Ohio 45432



In order for UES to provide quick turn around of your bills for service, we request your assistance in complying with the following schedule. The dates indicated are the dates your bills MUST be at UES. Please allow adequate mailing time for UES to receive your bills by the dates indicated

DATES BILLS MUST BE AT UES

April 7, 21  
May 6, 23  
June 8, 23  
July 7, 21  
August 8, 23  
September 8, 22  
October 6, 21

DATES CHECKS WILL BE MAILED

April 15, May 2  
May 16, 31  
June 15, 30  
July 15, Aug. 1  
August 15, 30  
September 13, 50  
October 17, 31  
November 15, 30

For bills received on or before these dates, UES will be able to process checks to you in the mail by the 15th and 30th. For bills received after these dates, the checks may not be processed until the next pay period, causing a two week delay in your receiving your check.

Your bill may be for any period of time. It does not have to start on a Monday or end on a Friday. Your bill may be for any period convenient for you to meet our billing dates listed above. Please note these are the dates the bill must be at UES. For example, a bill received on or before April 7 will be mailed out to you on April 15. A bill received on April 8 will not be mailed until the April 25 bills are processed on May 2.

APPENDIX 1.B

PARTICIPANT'S QUESTIONNAIRE & REPLY SUMMARY

1988 USAF/UES GRADUATE STUDENT SUMMER SUPPORT PROGRAM  
EVALUATION QUESTIONNAIRE  
(TO BE COMPLETED BY GRADUATE STUDENT PARTICIPANT)

Name\_\_\_\_\_Title\_\_\_\_\_

Dept. (at home)\_\_\_\_\_Home Institution\_\_\_\_\_

Summer Supervising Professor\_\_\_\_\_

Research Colleague(s)\_\_\_\_\_

Laboratory Address of Colleague(s)\_\_\_\_\_

Brief Title of Research Topic\_\_\_\_\_

A. TECHNICAL ASPECTS

1. Was the offer of research assignment within your field of competency and/or interest? YES\_\_\_\_\_NO\_\_\_\_\_.

2. Was the work challenging? YES\_\_\_\_\_NO\_\_\_\_\_. If no, what would have made it so?\_\_\_\_\_

3. Were your relations with your Supervising Professor and research colleague satisfactory from a technical point of view? YES\_\_\_\_\_NO\_\_\_\_\_. If no, why?\_\_\_\_\_

4. Suggestions for improvement of relationship(s).\_\_\_\_\_

5. Considering the circumstances of a summer program, were you afforded adequate facilities and support? YES\_\_\_\_\_NO\_\_\_\_\_. If no, what did you need and why was it not provided?\_\_\_\_\_

6. Considering the calendar "window" of ten weeks being limited by varying college and university schedules, please comment on the program length. Did you accomplish: more than\_\_\_\_\_, less than\_\_\_\_\_, about what you expected\_\_\_\_\_?

GRADUATE STUDENT QUESTIONNAIRE  
(Page 2 of 3)

7. Do you feel the Graduate Student appointment should continue to require affiliation with a Summer Research Faculty Member? YES\_\_\_\_\_ NO\_\_\_\_\_.

8. Were you asked to present seminars on your work and/or your basic expertise? YES\_\_\_\_\_NO\_\_\_\_\_. Please list number, dates, approximate attendance, length of seminars, title of presentations (ues reverse side if necessary).

9. Were you asked to participate in regular meetings in your laboratory? YES\_\_\_\_\_NO\_\_\_\_\_. If yes, approximately how often?\_\_\_\_\_

10. Other comments concerning any "extra" activities.\_\_\_\_\_

11. On a scale of A to D, how would you rate this program? (A high, D low)

Technically challenging	A	B	C	D
Future research opportunity	A	B	C	D
Professional association	A	B	C	D
Enhancement of my academic qualifications	A	B	C	D
Enhancement of my research qualifications	A	B	C	D
Overall value	A	B	C	D

B. ADMINISTRATIVE ASPECTS

1. How did you first hear of this program?\_\_\_\_\_

2. What aspect of the program was the most decisive in causing you to apply?\_\_\_\_\_

GRADUATE STUDENT QUESTIONNAIRE  
(Page 3 of 3)

3. How do you rate the stipend level? Meager\_\_\_\_\_Adequate\_\_\_\_\_  
Generous\_\_\_\_\_.

4. Please give information on housing: Did you reside in VOQ\_\_\_\_\_,  
apartment\_\_\_\_\_, other (specify)\_\_\_\_\_? Name and address of apartment  
complex and manager's name.\_\_\_\_\_  
\_\_\_\_\_

5. Would you encourage or discourage expansion of the Student Program?  
\_\_\_\_\_Why?\_\_\_\_\_  
\_\_\_\_\_

6. Considering the many-faceted aspects of administration of a program  
of this magnitude, how do you rate the overall conduct of this program?  
Poor\_\_\_\_\_Fair\_\_\_\_\_Good\_\_\_\_\_Excellent\_\_\_\_\_. Please add any additional  
comments.\_\_\_\_\_  
\_\_\_\_\_

7. Please comment on what, in your opinion, are:

a. Strong points of the program:\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

b. Weak points of the program:\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

8. On balance, do you feel this has been a fruitful, worthwhile,  
constructive experience? YES\_\_\_\_\_NO\_\_\_\_\_.

9. Other remarks:\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

THANK YOU

QUESTIONNAIRE EVALUATION SUMMARY  
(Graduate Student)

A. TECHNICAL ASPECTS

1. Assignment in field of competency and/or interest? Yes - 89  
No - 2

2. Work challenging? Yes - 86  
No - 4

If no, why?

Of the two comments, one said it was not research per se, the other indicated that it was nothing "new".

3. Were your relations with colleagues satisfactory? Yes - 74  
No - 1

If no, why?

The one comment indicated expectation of greater supervision.

4. Suggestions for improvement of relationships?

The following areas were indicated as suggestions for improving relationships.

Clarify the program, procedures, goals - to both students and the university - prior to the start of the program's work session.

Require the research colleague to be in residence for the entire program.

Assign graduate students to Air Force personnel only.

Have a supervising professor; have professor work more directly with student; have student work with own graduate advisor.

Require lab discussions regularly (once a week); have more student input.

Extend the program - for entire academic year; provide for longer research period or follow-up period.

Allocate more time to the selection of colleagues and projects.

5. Were you afforded adequate facilities? Yes - 84  
No - 6
6. Accomplishment in ten weeks? More than expected - 19  
Less than expected - 24  
About what expected - 48
7. Do you feel the Graduate Student appointment should continue to require affiliation with a Summer Research Faculty Member?  
Yes - 47  
No - 43
8. Were you asked to present seminars? Yes - 29  
No - 62
9. Were you asked to participate in meetings? Yes - 45  
No - 46
10. Please give other comments on extra activities:

There were few comments. Four people said they attended a short course, symposium, regular seminars. A couple said they went to meetings including technical meetings with other government apprentices. Seven noted they had performed work/research - related activities such as support studies, hardware/software installation, use of technical library, etc. One had participated in recreational activities and another said he trained someone.

	A (HIGH)		D (LOW)	
11. Technically challenging	A- 59	B- 26	C- 5	D- 1
Future research opportunity	A- 68	B- 16	C- 6	D- 1
Professional association	A- 62	B- 24	C- 4	D- 1
Enhancement of my academic qualifications	A- 58	B- 26	C- 7	D- 0
Enhancement of my research qualifications	A- 73	B- 13	C- 5	D- 0
Overall value	A- 73	B- 17	C- 1	D- 0

## B. ADMINISTRATIVE ASPECTS

1. How did you first hear about program?
- |               |   |    |
|---------------|---|----|
| Colleagues    | - | 72 |
| Advertisement | - | 1  |
| Air Force     | - | 5  |
| Direct Mail   | - | 10 |

2. Decisive aspect of application?

NOTE, MANY PUT MORE THAN ONE ANSWER

Area of possible future research funding	-	3
Good research opportunity	-	82
Opportunity to work with USAF	-	9
Location	-	4
Financial support	-	6
Lead to a Thesis	-	9

3. Stipend level?
- |          |   |    |
|----------|---|----|
| Generous | - | 18 |
| Adequate | - | 70 |
| Meager   | - | 3  |

4. Housing information?
- |           |   |    |
|-----------|---|----|
| VOQ       | - | 7  |
| Apartment | - | 44 |
| Other     | - | 40 |

5. Would you encourage or discourage expansion of the Student Program?

Encourage	-	87
Discourage	-	2

Encourage, why?

Two general areas were cited as reasons:

To give students experience with "real world" research or applied research. Some even specified further that it gives a chance to explore chosen field, and also increases awareness of government-sponsored jobs as well as promotes exchange between government and academia.

To provide students with exposure to technology, facilities, contacts, and "different" people. Some felt it was beneficial in encouraging self-development and enhancing self-confidence.



Discourage, why

Only two discouraged this and for the following reasons:

"It appeared expansion would result in overcrowding.

"The amount of time spent on guest(s) researchers by sponsoring institutions in somewhat minimized by their own need to do research".

6. Program administration overall rating:

Excellent	-	53
Good	-	36
Fair	-	2
Poor	-	0

7a. Comments on the strong points of the program:

Review of the responses revealed the following general areas and corresponding breakdown. Many answers included more than one reason.

- 46 a) Good research opportunity; work experience in non-university setting.
- 20 b) Good facilities and resources.
- 27 c) Professional scientists; work relationships.
- 18 d) Exposure to Air Force research, exchange of knowledge; government/industry/academia communication.
- e) Contacts.
- f) Stipend
- g) Administration; "focused" nature of the program.
- h) Academic freedom and flexibility of program.

Note: One student said the primary attraction was the duration of the program.

7b. Comments on the weak points of the program:

Responses have been categorized and the breakdown noted as follows.

- 21 a) Time limit - too short (or too rigid).
- 10 b) Housing arrangements.
- 3 c) Low pay.

- 11 d) Administrative details such as inconvenient pay periods or payment disbursement, security clearance requirements, tax requirements.
- 3 e) Faculty shouldn't have students working with them.
- f) Lack of sufficient or timely information about services available, the role of UES, the objectives of the program, etc.
- g) Not enough direct contact with summer faculty or supervisor or fellow graduate students; coordination at research location.

A couple of students cited a specific concern from the problem of delay in obtaining resources due to a purchase freeze. Two cited paperwork and or politics required to start program. Only one noted problems with the physical work environment, citing noise as the issue. On other said limiting the final paper to 20 pages was a problem.

8. Has this been a fruitful, worthwhile, constructive experience?

Yes - 89

No - 1

9. Other remarks:

20 comments were general positive statements additionally, eight specifically complimented UES and seven praised the Air Force personnel. (One suggestion was to involve more area high schools and small colleges.) Three specified enjoying the research opportunities and/or work relationships including exposure to government work. Four participants cited specific contributions of the program in such areas as facilities, contacts, expanding knowledge. Housing arrangements posed a problem for five students and cashing out-of-town paychecks was noted by another as a problem area. While two students would have liked more information about the program in such areas as responsibilities of all parties involved, available resources, etc, three other participants had problems with the government rules and regulations, such as the security clearance requirement, on-base traffic regulations, etc.

The program was felt to be too short by four students. More specific complaints were delays in obtaining supplies (1); dissatisfaction with the questionnaire (1), which included suggestions for changing it; and a lack of background required for the project, which one alternate points out.

APPENDIX 1.C

LABORATORY REPRESENTATIVE'S QUESTIONNAIRE & REPLY SUMMARY

1988 USAF/UES SUMMER FACULTY RESEARCH PROGRAM

EVALUATION QUESTIONNAIRE

(TO BE COMPLETED BY LABORATORY REPRESENTATIVE)

Laboratory/Center \_\_\_\_\_

Name \_\_\_\_\_

1. How do you rate the correspondence, verbal and telephone communication, and other aspects concerning program administration?

Excellent\_\_\_\_ Good\_\_\_\_ Average\_\_\_\_ Poor\_\_\_\_ How could it be improved?

\_\_\_\_\_  
\_\_\_\_\_

2. The participant selection process is two-fold: academic and technical. Did you have sufficient time to conduct an evaluation of applications?

YES\_\_\_\_ NO\_\_\_\_

Comments: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

3. Was the number of faculty researchers assigned to your organization satisfactory?

YES\_\_\_\_ NO\_\_\_\_. If not, how many would be desired?\_\_\_\_\_ How do you determine this number?

\_\_\_\_\_  
\_\_\_\_\_

LABORATORY REPRESENTATIVE QUESTIONNAIRE (Page 2 of 5)

4. Please rate the expense-paid pre-program visit:

Essential\_\_\_\_ Convenient\_\_\_\_ Not worth the expense\_\_\_\_

5. In your opinion is the ten-week time period an optimum length of time to develop a viable working relationship among the faculty researchers, students, laboratory/center personnel and programs? YES\_\_\_\_ NO\_\_\_\_. If no, what length would it be.

\_\_\_\_\_  
\_\_\_\_\_

Other comments:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

6. Did your laboratory/center establish a seminar program, or other means, to "tap" the faculty associate's academic knowledge other than his research assignment? YES\_\_\_\_ NO\_\_\_\_.

If yes, give description and evaluation.\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

LABORATORY REPRESENTATIVE QUESTIONNAIRE (Page 3 of 5)

7. Did the laboratory/center conduct a general briefing, tour, and/or other formal means of welcome and introduction for the associate assigned to your organization?

YES\_\_\_\_ NO\_\_\_\_.

8. Did you have a formal exit exercise for each associate such as a final technical briefing presented to the organization management, a private interview, or other?

YES\_\_\_\_ NO\_\_\_\_.

9. In your opinion, what was the overall quality of this year's participants as measured by attitude, technical competence, work habits, production and meaningful research accomplishment?

(Note: These answers will be held confidential.)

List Names	<u>Superior</u>	<u>Excellent</u>	<u>Average</u>	<u>Poor</u>
------------	-----------------	------------------	----------------	-------------

10. Do you believe the Graduate Student Program enhances the Summer Research Program?

YES\_\_\_\_ NO\_\_\_\_

LABORATORY REPRESENTATIVE QUESTIONNAIRE (Page 4 of 5)

11. Was a student assigned under the Graduate Student Summer Support Program to your laboratory this summer? YES\_\_\_\_ NO\_\_\_\_. If so, was their participation productive? YES\_\_\_\_ NO\_\_\_\_.

12. Please furnish any recommendations you may have on improving the Graduate Student segment of the program.

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13. Site visits were made by Program Director and/or Administrator and the AFOSR representative. Do you feel these visits are beneficial to the program participants and Laboratory in understanding the management of the program? YES\_\_\_\_ NO\_\_\_\_. Do you feel these visits should be done again next year. YES\_\_\_\_ NO\_\_\_\_.

14. UES has a coordinator assigned at your base to assist the Summer Faculty participants in the administration of the program. Did you find this beneficial to the program. YES\_\_\_\_ NO\_\_\_\_. Are there any problem areas coordinators should administrator in future years?

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LABORATORY REPRESENTATIVE QUESTIONNAIRE (Page 5 of 5)

15. Please furnish any other comments or suggestion to improve the program in future years.

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1983s

THANK YOU



1988 USAF/UES SUMMER FACULTY RESEARCH PROGRAM  
EVALUATION QUESTIONNAIRE  
LABORATORY REPRESENTATIVE

1. How do you rate the correspondence, verbal and telephone communication, and other aspects concerning program administration?

Excellent - 10  
Good - 6  
Average - 2  
Poor -  
No Response -

How could it be improved?

Two comments were given: one requesting copies of the correspondence sent to SFRP participants; the other suggesting replacing a meeting with phone contact.

2. Did you have sufficient time to conduct an evaluation of applications?

Yes - 15  
No - 1

Comments:

The comments indicated there was time pressure, but recognized that the system precluded providing more time. One said administrative changes on the evaluator's part needed to be effected.

3. Was the number of faculty researchers assigned to your organization satisfactory?

Yes - 13  
No - 5

If no, how many would be desired?

The numbers ranged from 9 to 16 as indicated below, with comments included.

9. Consistent with the number requested by my researchers and the Math Lab I support.

15. Interest in this program in our technical divisions is quite high. A larger number of participants would allow us also to expand HBC participation in the SFRP.

14-16. Two professors per RADC directorate.

12. The growth of in-house research conducted within the Lab is such that an additional four faculty members could be well utilized.

10, by the number requested by research colleagues.

4. Please rate the expense-paid pre-program visit:

Essential	-	12
Convenient	-	5
Not worth the expense	-	

5. In your opinion is the ten week time period an optimum length of time to develop a viable working relationship among the faculty researchers, students, laboratory/center personnel and programs?

Yes	-	12
No	-	5
N/A	-	1

Other comments:

Five of the ten comments specified 12 weeks as desirable. Another suggested flexible periods of 10-13 weeks. Consistent with this were two comments saying it depended on whether previous work relationship had been established as to what the orientation or supervision would be a higher requirement. One recognized the constraints of the schedule as a reasonable trade-off to ensure more participants as a 12 week program would negatively affect potential number of participants because of university schedules.

6. Did your laboratory/center establish a seminar program, or other means, to "tap" the faculty associate's academic knowledge other than his research assignment?

Yes	-	10
No	-	8

If yes, give description and evaluation.

There seemed to be a variety of approaches to this, with only a few indicating regularly scheduled seminars, such as weekly meetings or seminars. Others had informal seminars and out-briefs. Some briefed in their area of expertise. One person said it was not as formal as he would have liked and was writing a plan to improve this (the report was to be sent to UES.)

7. Did the laboratory/center conduct a general briefing, tour, and/or other formal means of welcome and introduction for the associate assigned to your organization?

Yes	-	13
No	-	5

8. Did you have a formal exit exercise for each associate such as a final technical briefing presented to the organization management, a private interview, or other?

Yes - 12  
No - 6

9. In your opinion, what was the overall quality of this year's participants as measured by attitude, technical competence, work habits, production and meaningful research accomplishment?

List Names	<u>Superior</u>	<u>Excellent</u>	<u>Average</u>	<u>Poor</u>
	64	42	8	2

10. Do you believe the Graduate Student Program enhances the Summer Research Program?

Yes - 15  
No - 1  
N/A - 2

11. Was a student assigned under the Graduate Student Summer Support Program to your laboratory this summer?

Yes - 16  
No - 2  
N/A -

If so, was their participation productive?

Yes - 14  
No -

12. Please furnish any recommendations you may have on improving the Graduate Student segment of the program.

Three saw no problems and praised the program. A couple wanted to increase the number of positions. It was also suggested by two that students only be assigned with faculty members (and one specified that the professors bring their own graduate students and another said the student should have prior experience in working with a faculty summer participant.) A final comment was to have start dates for graduate students coincide with those of the professors with whom they will work.

13. Site visits were made by Program Director and/or Administrator and the AFOSR representative. Do you feel these visits are beneficial to the program participants and Laboratory in understanding the management of the program?

Yes - 15  
No - 2  
N/A - 1

Do you feel these visits should be done again next year?

Yes - 14  
No - 2

14. UES has a coordinator assigned at your base to assist the Summer Faculty participants in the administration of the program. Did you find this beneficial to the program?

Yes - 15  
No - 1  
N/A - 2

Are there any problem areas coordinators should administrator in future years?

Housing is a problem, as indicated by 4 of the 5 comments. Getting in touch early with both student and faculty could be a way of providing assistance in such areas. The other comment specifically praised the UES Coordinator for the outstanding job she has done.

15. Please furnish any other comments or suggestion to improve the program in future years.

Five expressed satisfaction with the program. One requested more mini-grants; another felt additional publicizing of the program would help. The combination of a summer faculty and graduate student was indicated by one to be more productive than either one working alone.

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## APPENDIX II

- A. Program Statistics
- B. List of 1988 Participants
- C. Participant Laboratory Assignments

APPENDIX II A

Summer Faculty Research Program  
Graduate Student Research Program

Sponsored by  
Air Force Office of Scientific Research

Conducted by  
Universal Energy Systems, Inc.

Program Statistics

## Program Statistics

### 1. Applications Received (by Laboratory)

Organization		1st Choice
Aerospace Medical Research Laboratory	(WPAFB)	15
Aero Propulsion Laboratory	(WPAFB)	6
Armament Laboratory	(Eglin)	10
Arnold Engineering Development Ctr.	(Arnold)	6
Astronautics Laboratory	(Edwards)	13
Avionics Laboratory	(WPAFB)	12
Eastern Space & Missile Center	(Patrick)	0
Electronic Systems Division	(Hanscom)	1
Engineering and Services Center	(Tyndall)	6
Flight Dynamics Laboratory	(WPAFB)	12
Frank J. Seiler Research Laboratory	(USAFA)	6
Geophysics Laboratory	(Hanscom)	6
Human Resources Laboratories	(Brooks)	18
Materials Laboratory	(WPAFB)	18
Occupational & Environment Health Lab.	(Brooks)	3
Rome Air Development Center	(Griffiss)	8
School of Aerospace Medicine	(Brooks)	23
Weapons Laboratory	(Kirtland)	6
Wilford Hall Medical Center	(Lackland)	13
	Totals	182

### 2. Number of Participants - 107

Number with Bachelors Degree	- 77
Number with Masters Degree	- 30

Program Statistics  
Continued

3. Number of Participants at Each Laboratory

Organization

Aerospace Medical Research Laboratory	(WPAFB)	10
Aero Propulsion Laboratory	(WPAFB)	1
Armament Laboratory	(Eglin)	6
Arnold Engineering Development Ctr.	(Arnold)	3
Astronautics Laboratory	(Edwards)	9
Avionics Laboratory	(WPAFB)	11
Eastern Space & Missile Center	(Patrick)	0
Electronic Systems Division	(Hanscom)	0
Engineering and Services Center	(Tyndall)	5
Flight Dynamics Laboratory	(WPAFB)	8
Frank J. Seiler Research Laboratory	(USAF)	3
Geophysics Laboratory	(Hanscom)	3
Human Resources Laboratories	(Brooks, Williams and WPAFB)	10
Materials Laboratory	(WPAFB)	10
Occupational & Environment Health Lab.	(Brooks)	1
Rome Air Development Center	(Griffiss)	5
School of Aerospace Medicine	(Brooks)	11
Weapons Laboratory	(Kirtland)	4
Wilford Hall Medical Center	(Lackland)	7
	Totals	107

4. Discipline Represented -

Aerospace Engineering	- 5	Geology	- 4
Atmospheric Science	- 1	Human Factors	- 1
Biology	- 4	Industrial Engineering	- 1
Business	- 1	Mathematics	- 3
Chemical Engineering	- 3	Medicine	- 3
Chemistry	- 7	Microbiology	- 2
Civil Engineering	- 2	Natural Science	- 1
Cognitive Psychology	- 1	Pathology	- 1
Computer Science	- 6	Physics	- 12
Dentistry	- 1	Physiology	- 1
Economics	- 2	Psychology	- 9
Electrical Engineering	- 14	Sociology	- 1
Engineering	- 5	Toxicology	- 1
Engineering Mechanics	- 14	Zoology	- 1
Epidemiology	- 1		
		Total	- 107



Program Statistics  
Continued

5. Colleges and Universities Represented - Total 58

Akron, University of	- 1	Miami, University of	- 2
Alabama, University of	- 2	Michigan State University	- 1
Alaska, University of	- 1	Michigan Technological Univ	- 1
Arizona State, University of	- 1	Minnesota, University of	- 1
Arkansas University	- 2	Missouri-Columbia, Univ. of	- 2
Ball State University	- 1	Montana State University	- 1
California State University	- 1	Murray State University	- 1
Carnegie Mellon	- 1	Nebraska-Lincoln, Univ. of	- 1
Cincinnati, University of	- 3	New Hampshire, University of	- 2
Colorado, University of	- 4	New York, State Univ. of	- 1
Colorado, University of	- 3	New York University	- 1
Cornell, University of	- 1	Northwestern University	- 1
Dayton, University of	- 4	Notre Dame, University of	- 1
Detroit, University of	- 1	Ohio State University	- 3
Florida, University of	- 1	Ohio University	- 3
Francis Marion College	- 1	Oregon Institute of Tech.	- 1
Georgia Inst. of Technology	- 3	Pennsylvania State Univ.	- 1
Illinois Inst. of Technology	- 1	Prairie View A&M University	- 1
Illinois, University of	- 3	Purdue University	- 1
Indiana Univ. of Pennsylvania	- 1	Southern Illinois University	- 2
Iowa, University of	- 1	Tennessee Space Institute	- 1
Jackson State University	- 2	Tennessee Tech. University	- 1
Jarvis Christian College	- 1	Texas, University of	- 3
Kansas State University	- 2	Texas A&M University	- 1
Kent State University	- 2	Trinity University	- 2
Louisiana State University	- 2	Vanderbilt University	- 1
Meharry Medical College	- 11	Virginia Polytechnic Inst.	
Memphis State University	- 1	and State University	- 5
Miami University	- 1	Washington University	- 1
		Wright State University	- 5
			Total 107

Program Statistics  
Continued

6.    States Represented -    Total   31

Alabama	- 2
Alaska	- 1
Arizona	- 1
Arkansas	- 2
California	- 2
Colorado	- 8
Florida	- 3
Georgia	- 3
Illinois	- 6
Indiana	- 2
Kansas	- 2
Kentucky	- 1
Louisiana	- 2
Maryland	- 1
Massachusetts	- 1
Michigan	- 4
Minnesota	- 1
Missouri	- 3
Mississippi	- 3
Montana	- 1
Nebraska	- 2
New Hampshire	- 1
New York	- 4
Ohio	- 21
Oregon	- 1
Pennsylvania	- 4
South Carolina	- 1
Tennessee	- 13
Texas	- 7
Virginia	- 3
Wisconsin	- 1

7.    Age of Participants -

Average -    27

APPENDIX II B

LIST OF PARTICIPANTS

# LIST OF 1988 PARTICIPANTS

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED
Ben A. Abbott Electrical Engineering Dept. Vanderbilt University Nashville, TN 37240 (615) 332-2723	<u>Degree:</u> B.S., Computer Science, 1983 <u>Specialty:</u> Electrical Engineering <u>Assigned:</u> Arnold Engineering Development Center
Antoinne C. Able Meharry Medical College 1005 D.B. Todd Blvd. P O Box 882 Nashville, TN 37208 (615) 361-5303	<u>Degree:</u> M.S., Biology, 1982 <u>Specialty:</u> Biology <u>Assigned:</u> Wilford Hall Medical Center
Stanley D. Adams College of Medicine Meharry Medical College 1005 D.B. Todd Blvd. Nashville, TN 37208 (615) 327-6204	<u>Degree:</u> B.S., Cellular & Molecular Biology, 1987 <u>Specialty:</u> Physiology <u>Assigned:</u> Wilford Hall Medical Center
John D. Allison Dept. of Psychology Univ. of Texas at Austin Mezes Hall 330 Austin, TX 78712 (512) 471-5857	<u>Degree:</u> M.A., Psychology, 1987 <u>Specialty:</u> Comparative Neurobiology <u>Assigned:</u> Human Resources Laboratory: Manpower and Personnel Div.
James E. Angelo Dept. of Physics Univ. of Minnesota - Duluth Duluth, MN 55812 (218) 726-7124	<u>Degree:</u> B.S., Math/Physics, 1986 <u>Specialty:</u> Applied Physics <u>Assigned:</u> Materials Laboratory
John E. Bambery Dept. of Physics University of Pennsylvania Indiana, PA 15701 (412) 357-2611	<u>Degree:</u> B.S. Physics, 1987 <u>Specialty:</u> Computer Analysis <u>Assigned:</u> Avionics Laboratory

Daniel W. Barineau  
Dept. of Engineering Science  
Virginia Tech.  
1300-B Terrace View Apts.  
Blacksburg, VA 24060  
(703) 552-7867

Degree: B.S., Chemical Eng., 1987  
Specialty: Engineering Mechanics  
Assigned: Harry G. Armstrong Aerospace  
Medical Research Laboratory

John W.J. Barnaby  
Dept. of Electrical Engineering  
University of Alabama  
Box 6169, 317 Houser Hall  
Tuscaloosa, AL 35487-6169  
(205) 348-6351

Degree: B.S., Electrical Eng., 1987  
Specialty: Electrical Engineering  
Assigned: School of Aerospace Medicine

Kathleen M. Bennett  
Dept. of Engineering Mgmt.  
University of Dayton  
300 College Park  
Dayton, OH 45469  
(513) 229-2699

Degree: B.S., Mechanical Eng., 1984  
Specialty: Engineering Management  
Assigned: Flight Dynamics Laboratory

Mark N. Beorkrem  
Dept. of Psychology  
Washington University  
One Brookings Drive  
Campus Box 1125  
St. Louis, MO 63130  
(314) 889-6536

Degree: B.S., Psychology, 1987  
Specialty: Organizational Behavior  
Assigned: Human Resources Laboratory:  
Operations Training Div.

Joel L. Berg  
Dept. of Eng. Science & Mech.  
Virginia Polytechnic Inst.&S.U.  
Blacksburg, VA 24061  
(703) 961-6326

Degree: M.S., Engr. Mechanics, 1984  
Specialty: Structural Vibrations  
Assigned: Astronautics Laboratory

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Specialty: Condensed Matter Physics  
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Assigned: Armament Laboratory

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Degree: B.S., Electrical Eng., 1988  
Specialty: Electrical Engineering  
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Assigned: Weapons Laboratory

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Specialty: Solid State Physics  
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Degree: B.S., Aerospace Eng., 1987  
Specialty: Engineering Mechanics  
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Degree: B.S. Physics, 1986  
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Specialty: Psychology  
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Operations Training Div.

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Assigned: School of Aerospace Medicine

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Specialty: Computer Science  
Assigned: Rome Air Development Center

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Training Systems

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Specialty: Controls  
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Specialty: Neural Network  
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Medical Research Laboratory

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Manpower and Personnel Div.

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Specialty: Systems Modeling & Dynamics  
Assigned: Materials Laboratory

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Degree: B.S., Chemical Eng., 1988  
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Degree: B.S., Mechanical Eng., 1987  
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Degree: M.A., Exp. Psychology, 1978  
Specialty: Cognitive Psychology  
Assigned: Harry G. Armstrong Aerospace  
Medical Research Laboratory

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Mechanics, 1988  
Specialty: Engineering Mechanics  
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Specialty: Biology  
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Assigned: Occupational and Environment  
Health Laboratory

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Specialty: Space Sciences  
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Development Center

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Specialty: Experimental Psychology  
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Degree: B.S., Biology, 1988  
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Specialty: Unsteady Aerodynamics  
Assigned: Frank. J. Seiler Research Lab.

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Medical Research Laboratory

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Specialty: Electrical Engineering  
Assigned: Flight Dynamics Laboratory

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Specialty: Computational Fluid Dynamics  
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Specialty: Communications Systems  
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Specialty: Signal Processing  
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Medical Research Laboratory

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Medical Research Laboratory

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Specialty: Structural Mechanics  
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Specialty: Sensory Neurophysiology  
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Specialty: Computational Fluid Mechanics  
Assigned: Arnold Engineering  
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Specialty: Image Coding  
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Medical Research Laboratory

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Specialty: Pattern Recognition  
Assigned: Avionics Laboratory

APPENDIX II C  
PARTICIPANT LABORATORY ASSIGNMENT

C. PARTICIPANT LABORATORY ASSIGNMENT (Page 1)

1988 USAF/UES GRADUATE STUDENT RESEARCH PROGRAM

AERO PROPULSION LABORATORY (AFWAL/APL)  
(Wright-Patterson Air Force Base)

1. Robert Riley

ARMAMENT LABORATORY (AD)  
(Eglin Air Force Base)

1. George Boynton

2. David Chenault

3. Thomas Harkins

4. Hisook Min

5. Thomas Olsen

6. Anne Siegman

HARRY G. ARMSTRONG AEROSPACE MEDICAL RESEARCH LABORATORY (AAMRL)  
(Wright-Patterson Air Force Base)

1. Daniel Barineau

2. Michael Ellis

3. Virginia Gunther

4. Stephen Jenei

5. Elizabeth Kavran

6. Richard Kunze

7. Deborah Mitchell

8. Jacqueline Roberts

9. Christopher Sullivan

10. Lisa Weinstein

ARNOLD ENGINEERING DEVELOPMENT CENTER (AEDC)  
(Arnold Air Force Base)

1. Ben Abbott

2. Keith Krapels

3. Robert Tramel

ASTRONAUTICS LABORATORY (AL)  
(Edwards Air Force Base)

1. Joel Berg

2. Lance Carter

3. William Geisler

4. David Graham

5. Gray Griesheim

6. Steven Kahn

7. Christopher Kocher

8. Michael Koharchik

9. William Moran

AVIONICS LABORATORY (AFWAL/AL)  
(Wright-Patterson Air Force Base)

1. John Bambery

2. Kevin Carmichael

3. Daniel Cook

4. Edward Grissom

5. Yuhong Li

6. Randal Mandock

7. Phillip Pace

8. Eric Schmidt

9. Tien Tran

10. John VanLassel

11. Michael Zmuda

ENGINEERING AND SERVICES CENTER (ESC)  
(Tyndall Air Force Base)

1. Mark Brusseau

2. Douglas Hansen

3. David McKenzie

4. James Normann

5. Steven Pierce

C. PARTICIPANT LABORATORY ASSIGNMENT (Page 2)

FLIGHT DYNAMICS LABORATORY (FDL)

(Wright-Patterson Air Force Base)

- |                     |                       |
|---------------------|-----------------------|
| 1. Kathleen Bennett | 5. William Morse      |
| 2. Susan Dumbacher  | 6. Gregory Schoeppner |
| 3. Bryan Foos       | 7. Richard Swift      |
| 4. Norman Holmes    | 8. David Thompson     |

FRANK J. SEILER RESEARCH LABORATORY (FJSRL)

(USAF Academy)

1. Bruce Bullard
2. Jennifer Joyce
3. Salvatore Miceli

GEOPHYSICS LABORATORY (AFGL)

(Hansom Air Force Base)

1. Thomas Kimble
2. Scharine Kirchoff
3. Thomas Pentecost

HUMAN RESOURCES LABORATORY

(Brooks, Williams and Wright-Patterson Air Force Bases)

- |                    |                   |
|--------------------|-------------------|
| 1. John Allison    | 6. Charles King   |
| 2. Mark Beorkrem   | 7. David Mayfield |
| 3. Patricia Cooper | 8. Jerome Nadel   |
| 4. Charles Drake   | 9. Peter Pidcoe   |
| 5. Peter Gaddis    | 10. Douglas Sego  |

MATERIALS LABORATORY (ML)

(Wright-Patterson Air Force Base)

- |                   |                     |
|-------------------|---------------------|
| 1. James Angelo   | 6. Jeff Simmons     |
| 2. Darwin Boyd    | 7. David Swick      |
| 3. Douglas Gagne  | 8. Ronald Tomlinson |
| 4. Robert Goetz   | 9. Deborah Vezie    |
| 5. Andrew Hensley | 10. Oden Warren     |

OCCUPATIONAL AND ENVIRONMENT HEALTH LABORATORY (OEHL)

(Brooks Air Force Base)

1. Phyllis Keys

C. PARTICIPANT LABORATORY ASSIGNMENT (Page 3)

ROME AIR DEVELOPMENT CENTER (RADC)  
(Griffiss Air Force Base)

- |                     |                  |
|---------------------|------------------|
| 1. Richard Courtney | 4. Matthew Rubin |
| 2. Gary Hellenga    | 5. Daryl Sprehn  |
| 3. Robert Petroit   |                  |

SCHOOL OF AEROSPACE MEDICINE (SAM)  
(Brooks Air Force Base)

- |                   |                       |
|-------------------|-----------------------|
| 1. John Barnaby   | 7. Conrad Murray      |
| 2. Otis Cosby     | 8. Christine Nelson   |
| 3. Jerry Dillon   | 9. Julia Rennenkampff |
| 4. Ernest Freeman | 10. Mary Ritter       |
| 5. Thomas Lane    | 11. James Roberts     |
| 6. Yolanda Malone |                       |

WEAPONS LABORATORY (WL)  
(Kirtland Air Force Base)

- |                   |                     |
|-------------------|---------------------|
| 1. Franklin Bynum | 3. John McCord      |
| 2. Alan Jewell    | 4. Brian Spielbusch |

WILFORD HALL MEDICAL CENTER (WHMC)  
(Lackland Air Force Base)

- |                  |                   |
|------------------|-------------------|
| 1. Antoinne Able | 5. John Salinas   |
| 2. Stanley Adams | 6. Kimberly Smith |
| 3. Bobby Larry   | 7. Paul Tanner    |
| 4. Aleshia Lewis |                   |

### APPENDIX III

- A. Listing of Research Reports Submitted in the  
1988 Graduate Student Research Program
- B. Abstracts of the 1988 Summer Fellow's  
Research Reports



APPENDIX III A

LIST OF RESEARCH REPORTS

RESEARCH REPORTS  
1988 GRADUATE STUDENT RESEARCH PROGRAM

<u>Technical Report Number</u>	<u>Title</u>	<u>Graduate Researcher</u>
Volume I		
Armament Laboratory		
1	Two Dimensional Simulation of Railgun Plasma Armatures	George C. Boynton
2	Mueller Matrix Infrared Polarimetry	David Chenault
3	Determining the Aerodynamic Coefficients of High L/D Projectiles Using a Body-Fixed Coordinate System	Thomas Harkins
4	Filter Design and Signal Processing in the Development of Target-Aerosol Discrimination Techniques for Active Optical Proximity Sensors	Hisook Min
5	Viscous Grid Generation About a Two-Store Mutual Interference Problem	Thomas Olsen
6	Arima Modeling of Residuals in AD/KR TDOP Models *** Same Report as Dr. Shamma***	Anne Siegman
Arnold Engineering Development Center		
7	MULTIGRAPH Kernel for Transputer Based Systems	Ben Abbott
8	Performance Analyses of an IR Laser Scanner System Utilizing Bragg Cell Deflectors and Modulator for Writing Directly on FPAs Under Test	Keith Krapels
9	Test of a Locally Implicit Method for the Euler Equations and an Artificial Dissipation Scheme	Robert Tramel
Astronautics Laboratory		
10	Ground-Based Experimental Control Techniques for Space-Based Structures	Joel Berg
11	An Observer Design for the AFAL Grid	Lance Carter
12	Rheometrics Stress Rheometer Applications	William Geisler

13	Stability of Jets Under the Supercritical State	David Graham
14	In-Plane Fracture in 2-D Carbon-Carbon	Gary Griesheim
15	Experimental Verification of Identification Spillover for Distributed Structures	Steven Kahn
16	The Effects of Elevated Temperature Exposure on the Strength and Micro-structure of 2-D Carbon-Carbon	Christopher Kocher
17	Composite-Embedded Fiber-Optic Strain Sensors *** Same Report as Dr. David Jensen ***	Michael Koharchik
18	The Photochemistry of $\mu$ 3-( $\eta$ -Diethylacetylene)-Decacarbonyltriosmium in Solid Argon *** Same Report as Dr. Susan Collins ***	William Moran
Engineering and Services Center		
19	Investigation of Sorption Kinetics	Mark Brusseau
20	Estimation of Jet Fuel Contamination in Soils *** Same Report as Prof. Durnford ***	Douglas Hansen
21	Soil Vapor Extraction of Volatile Organic Chemicals *** Same Report as Prof. Hutzler ***	David McKenzie
22	Evaluation of the Computer Program 'Structural Analysis for Severe Dynamic Environments'	James Normann
23	High Intensity Stress Wave Propagation in Partially Saturated Sand *** Same Report as Prof. Wayne Charlie ***	Steven Pierce
Frank J. Seiler Research Laboratory		
24	Super Conducting Thin Films by Laser Evaporation of Bulk Material	Bruce Bullard
25	The Effects of Sodium Chloride on Room Temperature Molten Salts	Jennifer Joyce
26	Unsteady Multiple Body Studies for Two-Dimensional and Three-Dimensional Experiments	Salvatore Miceli

Geophysics Laboratory

- |    |   |                   |
|----|---|-------------------|
| 27 | No Report Submitted at this Time  | Thomas Kimble     |
| 28 | An Investigation of Economic Explosions in Littleton, Massachusetts and Healy, Alaska | Scharine Kirchoff |
| 29 | Gas Phase Ion-Molecule Reactions of Carbocations                                      | Thomas Pentecost  |

Rome Air Development Center

- |    |  |                  |
|----|--|------------------|
| 30 | Evaluation of Software Structured Designs Using Metrics  | Richard Courtney |
| 31 | Free-Space Laser Communications Simulator Program  | Gary Hellenga    |
| 32 | The Effects of Nonlinearities of High Speed Analog-to-Digital Converters on Digital Beamforming Arrays<br>***Same Report as Dr. Donald Ucci*** | Robert Petroit   |
| 33 | Metal Semiconductor Field Effect Transistor Computer Modelling and Electron Transport Computation  | Matthew Rubin    |
| 34 | Noise Calculations in a RADAR Receiver<br>*** Same Report as Dr. Beryl Barber ***  | Daryl Sprehn     |

Weapons Laboratory

- |    |   |                  |
|----|---|------------------|
| 35 | Chemical Kinetics Information Collected for IF Flow Tube, Report Period 1 June to 8 August 1988   | Franklin Bynum   |
| 36 | Stochastic Site Characterization and Modelling  | Alan Jewell      |
| 37 | Guide for the Diode Laser System to be Used in the Study of SO Radical                            | John McCord      |
| 38 | The Experimental Validation of Imaging Correlography Through Atmospheric Intensity Scintillations | Brian Spielbusch |

Volume II

Air Force Wright Aeronautical Laboratories

Aero Propulsion Laboratory

- |    |   |              |
|----|---|--------------|
| 39 | An Experimental Investigation of Fractal Surfaces in Turbulent Diffusion Flames | Robert Riley |
|----|---|--------------|

Avionics Laboratory

- |    |   |              |
|----|---|--------------|
| 40 | Thermionic Emission vs. Drift-Diffusion and the Placement of the Spike Layer for the BICFET | John Bambery |
|----|---|--------------|

41	Finite Elements Simulation of the Resonant Tunneling Diode	Kevin Carmichael
42	Software Tools Modeling Low Voltage Beam Steering Devices	Daniel Cook
43	Acquisition of Digital Radar Data for Use on the Improved TSPX Software	Edward Grissom
44	Model-based Target Recognition Using Laser Radar Imagery *** Same Report as Prof. Robert Li ***	Yuhong Li
45	A Proposed Turbulence Monitoring Facility For Wright-Patterson Air Force Base	Randal Mandock
46	Lightwave Systems and Device Database Development	Phillip Pace
47	A Study of Sky Backgrounds and Sub-Visual Cirrus	Eric Schmidt
48	Adaptive Array Architectures with Low-Sensitivity to Random Errors in the Steering Vector Elements	Tien Tran
49	Extraction of Circuit Definitions from VHDL Specifications	John Vanlassel
50	Applications of Evolutionary Learning Strategies to Pattern Recognition Tasks *** Same Report as Prof. Mateen Rizki ***	Michael Zmuda
Flight Dynamics Laboratory		
51	A Computer Model for Air-to-Air Combat (Force on Force) Assessment ***Same Report as Dr. P. Sweeney***	Kathleen Bennett
52	Evaluations of Suboptimal Filters as Applied to Large Flexible Space Structures	Susan Dumbacher
53	No Report Submitted at this Time	Bryan Foos
54	Development of an Aircraft Tire-Wheel Interface Model for Flange/Beadseat Contact Loads *** Same Report as Prof. James Sherwood ***	Norman Holmes
55	A Flight Control Reconfiguration Study Using Model Reference Adaptive Control	William Morse

56	Damage in Graphite/Epoxy Plates Subjected to Low Velocity Impact *** Same Report as Prof. William Wolfe ***	Gregory Schoeppner
57	Finite Element Analysis for Preliminary Structural Design/Optimization	Richard Swift
58	Optimal and Sub-Optimal Loop Shaping in Quantitative Feedback Theory	David Thompson
Materials Laboratory		
59	Photoreflectance as a Characterization Tool for Gallium Arsinide and Aluminum Gallium Arsinide Materials	James Angelo
60	Analytical and Numerical Solutions of the Nonlinear Diffusion Equation	Darwin Boyd
61	QPA Control of the End Milling Process ***Same Report as Prof. Barry Fussell ***	Douglas Gagne
62	Can Design for Extruded Powder Metallurgy Materials, and the Effects of Can Geometry and Can Material on the Powder Metallurgy Material Core	Robert Goetz
63	Interface Resistivity Modelling of the Hot Rolling of Ti-48Al-1V	Andrew Hensley
64	Phase Relationships in Al-Nb-X Ternary Alloy Systems	Jeff Simmons
65	Design of mechanical joints and their implications to the implementation of a comprehensive computer aided design package	David Swick
66	The Study of Trimethylsilyl polyphosphate (PPSE) as a Dehydrating Agent for Polymerizations and Model Compound Preparations of N-Phenylbenzimidazoles	Ronald Tomlinson
67	No Report Submitted at this Time	Deborah Vezie
68	Effect of Various Metals on the Thermal Degradation of a Chlorotrifluorethylene Based Fluid ***Same Report as Dr. Vijay Gupta***	Oden Warren

Volume III

Human Systems Divisions Laboratories

Harry G. Armstrong Aerospace Medical Research Laboratory

- |    |   |                      |
|----|---|----------------------|
| 69 | Improvements in the Control of Robotic Arm Simulations Using the Articulated Total Body (ATB) Model                       | Daniel Barineau      |
| 70 | Auditory Modeling<br>***Same Report as Dr. David Covington***   | Michael Ellis        |
| 71 | Performance in a Visual Monitoring Task with Serial and Simultaneous Display Formats<br>*** Same as Prof. David Payne *** | Virginia Gunther     |
| 72 | Evaluation of the Toxic Effects of a 90-Day Continuous Exposure of Rats and to Shale Derived JP-4 Jet Fuel                | Stephen Jenei        |
| 73 | Ceramic Composite Materials for Establishing Ingrowth of Bone and Developing Bone Remodeling Models                       | Elizabeth Kavran     |
| 74 | Visual-Spatial Localization with a Helmet-Mounted Display   | Richard Kunze        |
| 75 | Evaluation of an Extraction Procedure for the Analysis of Serum Steroids<br>*** Same Report as Prof. Masingale ***        | Deborah Mitchell     |
| 76 | Nephrotoxicity of 2,5-DMH in Fischer 344 Rats   | Jacqueline Roberts   |
| 77 | Physiological Measures of Workload During Actual Flight   | Christopher Sullivan |
| 78 | Ground-Texture Information for Aimpoint Estimation  | Lisa Weinstein       |

Human Resources Laboratory

- |    |   |                 |
|----|---|-----------------|
| 79 | The Relationship Between Inspection Time and Intelligence<br>*** Same Report as Dr. Robert Young ***  | John Allison    |
| 80 | Effectiveness of Contract Monitors in an Air Force Human Resources Laboratory: Prediction and Measurement<br>*** Same Report as Dr. Alan Witt *** | Mark Beorkrem   |
| 81 | No Report Submitted at this Time  | Patricia Cooper |

82	An Intelligent Tutor for the IBM System/360 Assembly Language: BIGBLUE *** Same Report as Dr. Sunita Rana ***	Charles Drake
83	Underlying Distributions of the New PACE Variables	Peter Gaddis
84	Development of a General Reliability Simulation Model	Charles King
85	Development of a Candidate Task Taxonomy for Air Force Enlisted Specialties	David Mayfield
86	Form Distortions in Computer Generated Moving Objects: An Assessment of Display Parameters	Jerome Nadel
87	Oculomotor Response to Sinusoidal Stimuli	Peter Pidcoe
88	Air Force Training Evaluation System: A Case Study	Douglas Sego
Occupational and Environmental Health Laboratory		
89	Evaluation of T-9 Noise Suppressor System at McConnell AFB, Kansas	Phyllis Keys
School of Aerospace Medicine		
90	No Report Submitted at this Time	John Barnaby
91	No Report Submitted at this Time	Otis Cosby
92	Standardization of DAIM Precipitate	Jerry Dillon
93	Membrane Alterations Involved in Evoked Release of L-Glutamic Acid from Mossy Fiber Synaptosomes	Ernest Freeman
94	Development of Improved Assays for Cholesterol and Major Lipoprotein Fractions *** Same Report as Dr. Eric Johnson ***	Thomas Lane
95	Glaucoma in U.S. Air Force Aviators - USAF School of Aerospace Medicine Study Group	Yolanda Malone
96	The Separation of HDL2 and HDL3 Using the Technique of Ultracentrifugation *** Same Report as Prof. Joe Ross ***	Conrad Murray
97	Light Beam Interaction Induced by a Transition Metal Complexed to a Tridentate Ligand	Christine Nelson



98	Electromagnetic Wave Propagation in a One-Dimensional Random Medium	Julia Rennenkampff
99	Synchronization of the Chlamydomonas reinhardtii cell cycle through light-dark cycling for subsequent testing with infra-red laser light in experiments concerning human night vision	Mary Ritter
100	Application of Nonlinear Filters to VEP Data *** Same Report as Prof. H. Longbotham ***	James Roberts
Wilford Hall Medical Center		
101	Three Selected Areas of Research in Endocrinology and Metabolism	Antoinne Able
102	Utility of Sensitive Immunoradiometric Assay (IRMA) to Predict Results of Thyroliberin Stimulation Test	Stanley Adams
103	Dental Materials	Bobby Larry
104	In Vitro Culture of Human Keratinocytes with Subsequent Induction of Stratification	Aleshia Lewis
105	Autologous Bone Marrow Transplant for Poor Prognosis Lymphomas - A Pilot Dose Escalation Study of a BACE Regimen and Follow-Up	John Salinas
106	Abdominal Abscess Formation in the Mouse Model	Kimberly Smith
107	I. Impact of Diabetes Mellitus on Overall Health and Functional Status: A Comparison of Two Instruments of Measurement. II. A Comparison of the Effects of Alprazolam, Amitriptyline, and Placebo on Reaction Time in Patients with Chronic Low Back Pain	Paul Ianner

1984s

APPENDIX III B

ABSTRACTS

ABSTRACTS  
ARMAMENT LABORATORY

ABSTRACTS  
ARMAMENT LABORATORY

Two Dimensional Simulation of

Railgun Plasma Armatures

by

Manuel A. Huerta

George Boynton

ABSTRACT

We report on our development of a two dimensional MHD code to simulate the internal dynamics of a railgun plasma armature. We use the equations of resistive MHD, with Ohmic heating, and radiation heat transport. We use an explicit Flux Corrected Transport code to advance all quantities in time. Preliminary runs show the growth and shedding of plasma structures in response to a small perturbation upon an initial equilibrium. We completed a run of an isothermal plasma armature that reached the end of a 1 m barrel. We have done many debugging runs of a full radiation heat transport model. At this point we are completing the revised code for this model. We expect to run it in a Cray-2 in the near future.

# Mueller Matrix Infrared Polarimetry

by

David B. Chenault

## ABSTRACT

A polarimeter which operates in the infrared is described. The instrument is capable of measuring the Mueller matrix of crystalline or liquid samples throughout the 3 to 14  $\mu\text{m}$  wavelength region using various infrared lasers or filtered blackbodies as sources. Mueller matrix processing is done immediately following data acquisition. The computer system which advances the rotating elements, acquires and processes the data is described. A system simulation was accomplished and an error analysis is presented. Results using a  $\text{CO}_2$  laser source and several known samples are given. Issues for further research are discussed.

Determining the Aerodynamic Coefficients  
of High L/D Projectiles Using a  
Body-Fixed Coordinate System

by

Thomas Harkins

ABSTRACT

The objective of this research effort was to develop a method of determining the aerodynamic coefficients of flexible aeroballistic models using a body-fixed coordinate system. The experimental data were obtained from spark range shadowgraph stations. A FORTRAN program was developed to provide a "best fit" to the data and thereby converge to a solution set containing the aerodynamic coefficients. The computer program used a Least Squares parameter estimation technique with differential correction. Analytical aerodynamic models for both rigid-body and flexible-body cases were included in the coefficient extraction program.

A test calculation for a missile with L/D of 50 was performed in which the aerodynamic coefficients for the flexible body were determined by comparison with the rigid body trajectory. The flexible body coefficients, in some cases, deviated by more than the expected probable error from the rigid body values. Further parametric calculations are currently under way to isolate the flexibility effects on specific coefficients.

Filter Design and Signal Processing  
in the Development of  
Target-Aerosol Discrimination Techniques  
for Active Optical Proximity Sensors

by

Hisook L. Min

ABSTRACT

Over a decade numerous efforts have been pursued by USAF in the development of all-weather Active Optical Proximity Sensors. The principal investigator (KSM) has undertaken an assignment of developing an alternate approach or new algorithms for this challenging objective. A few new techniques for the aerosol-target discrimination have been initiated and formulated by the principal investigator. The tasks of designing appropriate filters, comparing the effectiveness of several orthogonal basis functions in the filter design, coding, execution, and running simulations have been carried out by this writer. Programs were written in C-language and pascal for modularity. Extensive use of graphics are made for the relevant illustrations. Listings of the source codes are to be included in a proposed separate report to the AFATL (jointly with the PI). A proposal for a paper presentation at the upcoming IEEE International Conference on Acoustics, Speech, and Signal Processing (1989) has been submitted based on this work.



Viscous Grid Generation  
About a Two-Store Mutual  
Interference Problem

by

Thomas H. Olsen

ABSTRACT

Studies of the mutual interference flow problem have shown that a viscous flow field exists. Therefore, due to the importance of this problem to the study of store/aircraft combatibility, viscous modeling of this flow field is necessary. The first step in the computational modeling of a viscous problem is the development of a viscous grid. In this study, a computational mesh for a two-store mutual interference problem was generated using patched grids. However, because of a problem with off-boundary spacing, a viscous grid was not obtained. Once the grid lines can be made to follow the body, a viscous grid will be obtained.

# ARIMA MODELING OF RESIDUALS IN AD/KR TDOP MODELS

by

Shawky E. Shamma and Anne L. Siegman

## ABSTRACT

The measurement residuals generated by AD/KR Test Data Optimal Processor (TDOP) for extracting optimal vehicle trajectory depend on the error model used in the software for the measurement processing. These residuals are found often to be correlated, not white noise as assumed by TDOP. A set of software and algorithms for time series analysis which makes use of ARIMA (autoregressive integrated moving average) has been used to analyze some of the measurement residuals obtained from TDOP output and obtain the ARIMA model coefficients that fit the measurement residuals and that can be used in turn to correct the raw measurements for a rerun of TDOP software or in a "renovation" processing of TDOP.

The advantage of this approach is that one can achieve an improved accuracy in applying TDOP in tracking, weapon scoring, and system accuracy evaluations.

ABSTRACTS  
ARNOLD ENGINEERING AND DEVELOPMENT CENTER

MULTIGRAPH Kernel for Transputer Based Systems

by

Ben A. Abbott

ABSTRACT

Development of a multi-Transputer distributed real-time kernel for signal processing and control applications was started. The resulting system will be a parallel execution environment allowing a large grain data-flow graph to be built and scheduled in a dynamic fashion. This execution environment hides the underlying hardware structure (a virtual machine) so as to allow knowledge based system builders to create and dynamically adapt a real-time system.

TEST OF A LOCALLY IMPLICIT METHOD FOR THE EULER  
EQUATIONS AND AN ARTIFICIAL DISSIPATION SCHEME

by

Robert W. Tramel

ABSTRACT

A locally implicit method for the solution of the unsteady one dimensional Euler equations of fluid mechanics is considered as well as a new artificial dissipation scheme based on the Hamiltonian structure of Eulerian fluid mechanics. The method is also tested with Jameson-type artificial dissipation terms. The method is tested both without and with artificial dissipation on the standard test problem proposed by Sod(1978). Results are reported for each case.

ABSTRACTS  
ASTRONAUTICS LABORATORY

Ground-Based Experimental Control Techniques  
for Space-Based Structures

by  
Joel L Berg

ABSTRACT

This report addresses the effects of gravity in ground-based experiments for space-based structures and also presents a procedure to take them into account. The method of computer simulations which allows one to determine the control actuator requirements is outlined. In addition, this report demonstrates that computer speed limitations have an effect on the choice of sensor quantity and actuator quantity for the equipment available and the grid structures constructed by the Air Force, and that the number of participatory modes affects the tradeoff between sensor quantity and actuator quantity.

An Observer Design for the AFAL Grid

by

Lance H. Carter

Abstract

A Luenberger observer was designed for use in the AFAL grid experiment. The observer produces modal state estimates based on accelerometer outputs and a discretized mathematical model. The design includes the effects of gravity on the accelerometers and noise. The observer performance was then experimentally evaluated using free and forced response grid data. Results show that an observer of this type can be successfully used in a grid control system as long as there exists careful structural modeling and observer pole placement.



## Rheometrics Stress Rheometer Applications

by

William Geisler

### ABSTRACT

A method of training AFAL-RKPL personnel in the use of the Rheometrics Stress Rheometer (RSR) was needed to reduce the large amount of time required to train an individual to operate the RSR. The report serves as a guide to the RSR for the newcomer. By working with the laboratory's technicians I was able to determine what information needed to be provided to the newcomer immediately and which information could easily be obtained from the RSR's operations guide.

## Stability of Jets Under the Supercritical State

by

David L. Graham

### ABSTRACT

A high pressure system was constructed to study straight and impinging jets of carbon dioxide. In the next few weeks, carbon dioxide above supercritical pressure and at sub/supercritical temperatures will be injected into a windowed high pressure chamber containing supercritical nitrogen. The jets will be photographed by a laser shadowgraph, to examine the stability of the shear layer and the transition to turbulence. The experiment is modelled to liquid rocket geometry, with the objective of a better understanding of fine spray in rocket and other high pressure conditions.

## IN-PLANE FRACTURE IN 2-D CARBON-CARBON

by

GARY GRIESHEIM

### ABSTRACT

Experimental results are reported from an on-going program studying in-plane fracture in 2-D carbon-carbon. The material used in this study was a laminated 2-D carbon-carbon composite containing WCA carbon cloth as the reinforcement. Compact tension specimens were extracted from the laminated composite and tested for their fracture behavior. Initial cracks were machined into the specimens using both V-notches and Chevron notches. Crack opening displacement measurements were taken during each fracture test.

The experimental fracture behavior of 2-D carbon-carbon is compared with assumptions which are fundamental to the theory of linear elastic fracture mechanics. Specific issues which are discussed include: effect of notch sharpness on fracture strength, relation of specimen compliance to crack length, effect of very small crack length on fracture strength, and the role played by nonlinear material behavior in the development of crack tip stresses.

Experimental Verification of Identification Spillover  
for Distributed Structures

by

Steven P. Kahn

ABSTRACT

Identification spillover is verified with the "Grid Experiment" using a modal identification technique [1]. The effects of spillover on the identified eigenvalues, eigenvectors, and natural frequencies are examined, and it is shown that the inclusion principle holds. Comparisons are made with the actual system parameters of interest and those obtained from the Ibrahim Time Domain method.

THE EFFECTS OF ELEVATED TEMPERATURE EXPOSURE  
ON THE STRENGTH AND MICROSTRUCTURE  
OF 2-D CARBON-CARBON

by

Christopher G. Kocher

ABSTRACT

2-D carbon-carbon material fabricated from T-300 fibers and a CVD matrix as exposed to a heat treatment temperature of 2350C. Tension and Iosipescu shear tests were performed on both heat treated and as-received material to investigate the effects of the elevated temperature exposure on the mechanical properties of the composite. It was found that the material subjected to the elevated temperature experienced a roughly 25 percent decrease in tensile strength in both the warp and fill directions, and the fill shear strength decreased by approximately 50 percent. Optical microscopy revealed that the heat treatment significantly increased the number of microcracks within the fiber bundles.

## Composite-Embedded Fiber-Optic Strain Sensors

by

David W. Jensen, Ph.D.

and

Michael J. Koharchik

### ABSTRACT

An experimental investigation was conducted on advanced composite structures with embedded fiber-optic strain sensors for smart structures applications. The fabrication procedure for embedding the sensors into advanced composite components was refined and the effects of the fiber optic inclusion on the tensile properties of composite laminates were examined. Difficulties encountered during fabrication involved maintaining the integrity and alignment of the optical fibers and protecting them during the filament winding and curing processes. Several 1.5 inch diameter composite tubes with embedded fiber-optic sensors were successfully fabricated. Preliminary results obtained from three independent optical systems, including an RF interferometer (NASA Langley Research Center), a Mach-Zehnder interferometer (Penn State University), and an optical time-domain reflectometer (G2 Corporation) indicate that further research is warranted, particularly in the area of interferometry. Additionally, two flat graphite/epoxy plates were filament wound and cut into one-inch wide specimens. Ten of these 22 specimens contained three embedded optical fibers each. Tensile tests conducted on these specimens indicated no discernible degradation in stiffness due to the embedded fiber-optic sensors.

THE PHOTOCHEMISTRY OF  $\mu_3$ -( $\eta$ -DIETHYLACETYLENE)-DECACARBONYLTRIOSMIUM  
IN SOLID ARGON

by

Susan Collins and Will Moran

ABSTRACT

The photochemistry of  $\mu_3$ -( $\eta$ -diethylacetylene)-decacarbonyl-triosmium (compound I) was studied by FTIR at 10K in argon matrices. Upon irradiation at 470 nm, compound I readily converted to a nonacarbonyl intermediate (compound II), accompanied by the elimination of carbon monoxide. The isomer of compound II, (compound III), is obtained at higher temperatures (>300 K) (1). This isomer is obtained when the methylene-hydrogen migrates along the molecule to form an Os-H-Os hydride bond. Compound III was not produced upon warming to 50 K. However, a 10 K matrix of this was prepared from a stable, room temperature sample. Compound III was found to form a new photoproduct (compound IV) at 10 K which has a spectrum similar to compound I. The photochromic properties and IR spectra of compounds I, II, and III are discussed. A structure for compound IV is postulated.

ABSTRACTS  
ENGINEERING AND SERVICES CENTER



## INVESTIGATION OF SORPTION KINETICS

by

MARK BRUSSEAU

### ABSTRACT

The sorption process is very important regarding the transport and fate of organic contaminants in the subsurface. Generally, sorption has been assumed to be at local equilibrium, to be linear, and singular. These assumptions simplify the equations required to model sorption. However, under certain conditions, these assumptions may be invalid. Methods to investigate the kinetics of sorption are needed. A specific experimental and mathematical approach is explored in this work. An inverse correlation was found between the sorption rate coefficient and the sorbent-water partition coefficient for an homologous series of chlorinated benzenes.

ESTIMATION OF JET FUEL CONTAMINATION IN SOILS

by

Deanna S. Durnford

Douglas Hansen

ABSTRACT

A petroleum product used for jet fuel called JP4 has been found in well bores penetrating unconfined aquifers underlying several air force bases. Because of the widespread use of JP4 and its potential for contamination of the vadose zone, an accurate method for predicting the total quantity and distribution of this fuel in the subsurface is essential.

A methodology that can be used to estimate the quantity of JP4 in soil from well bore data was developed and illustrated during this project. The basic data required was determined and laboratory column studies were used to illustrate the procedure.

# SOIL VAPOR EXTRACTION OF VOLATILE ORGANIC CHEMICALS

by

Dr. Neil J. Hutzler and  
David B. McKenzie

## ABSTRACT

Laboratory experiments were conducted to measure the rate of removal of volatile organic chemicals from unsaturated porous materials by vapor extraction. Columns were packed with uniform sand and a fired, porous clay and contaminated with water containing trichloroethylene, toluene, or 1,1,1-trichloroethane. Organic-free air was drawn through the column into a gas chromatograph, which was programmed for automatic sampling.

All volatile organic chemicals were effectively removed from the column by vapor extraction. TCE and toluene exhibited similar behavior because their volatility is approximately the same. 1,1,1-TCA, which has a higher air/water partitioning coefficient, was removed at a faster rate. Toluene and TCA were more slowly removed from the porous clay because of the time required for diffusion out of the particles.

The rates of vapor extraction as determined by experiments were compared to predictions made by a mathematical model of the soil column system. While the model could predict the early removal rates of the volatile compounds quite well, it did not simulate the tailing of the compounds seen in the experiments.

EVALUATION OF THE COMPUTER PROGRAM  
'STRUCTURAL ANALYSIS FOR SEVERE DYNAMIC ENVIRONMENTS'

by

J. Brian Normann

ABSTRACT

The computer program 'Structural Analysis for Severe Dynamic Environments' is evaluated on the basis of accuracy and ease of use. The SDOF beam portion of the program was run with a number of input files, each designed to simulate typical elements in actual structures. A number of input files were also run in the slab/box portion of the program, each designed to simulate elements of an actual scale model structure tested in explosions by the Air Force at Tyndall Air Force Base. Output from the program is compared to an analytical/empirical model, allowing the Air Force some measure of confidence in the output from the program. Agreement of values calculated by the program with measured and hand calculated values is good and use of the program is found to be quick and simple.

High Intensity Stress Wave  
Propagation in Partially Saturated Sand

by

Wayne A. Charlie, Ph.D., P.E.,  
and  
Steven J. Pierce

Abstract

We conducted high amplitude, Split Hopkinson Pressure Bar (SHPB) laboratory tests on specimens of 20-30 Ottawa and Eglin sands to evaluate the influence of saturation and capillary pressure on compressional wave velocity, stress transmission and damping. All specimens were compacted to a constant dry density and then subjected to a constant input stress. For specimens compacted at various water contents, both the wave speed and the transmitted stress ratio were found to increase as the saturation was increased from zero to approximately 30 percent and then decreased with increasing saturation. For specimens compacted dry, saturated and then desaturated utilizing the pressure-plate method, both the wave speed and the transmitted stress ratio were found to decrease with increasing saturation. Analysis of the experimental results indicates that these trends may be explained by the effect that capillary pressure has on the compaction effort required to compact the sands to a given dry density.

ABSTRACTS  
FRANK J. SEILER RESEARCH LABORATORY

Superconducting Thin Films

by

Laser Evaporation of Bulk Material

by

Bruce W. Bullard

ABSTRACT

A system was setup to grow superconducting thin films by laser evaporation and deposition without post annealing in oxygen. The target material is a bulk superconductor,  $\text{YBa}_2\text{Cu}_3\text{O}_{7-\delta}$ , that is ablated with a pulsed or Q-switched laser. The plasma plume that results is directed toward a dielectric substrate. The substrate is heated using a second laser. During the deposition, oxygen and ozone were flowed across the surface of the substrate. As of 26 August 1988, the final day of my GSRP, we had not produced a superconducting film.

THE EFFECTS OF SODIUM CHLORIDE ON ROOM

TEMPERATURE MOLTEN SALTS

by

Jennifer A. Joyce

ABSTRACT

The effects of sodium chloride on a room temperature molten salt composed of aluminum chloride and 1-methyl-3-ethyl-imidazolium chloride (MEICl) were studied. The effects of adding sodium chloride to melts of various compositions were studied, and the solubility of sodium chloride in the melts was quantified. In addition, cyclic voltammetry was used to study the effects of the sodium chloride on the acidity/basicity of the melts. These tests showed that sodium chloride is soluble in an acidic melt to the point that the melt becomes neutral. The salt is, however, slightly soluble in basic melts.

It was also discovered that subsequent addition of MEICl to an acidic melt saturated with sodium chloride caused sodium chloride to precipitate from the melt and the melt to become basic.



UNSTEADY MULTIPLE BODY STUDIES  
FOR TWO-DIMENSIONAL  
AND THREE-DIMENSIONAL EXPERIMENTS

by

Salvatore P. Miceli

ABSTRACT

Two different computational codes are being developed to investigate the unsteady aerodynamic phenomena produced by multiple body interactions. Wake-airfoil impingement and store separation represent a similar class of problems where the temporally and spatially variant boundary conditions can be modeled using the chimera mesh scheme. The current status of the code development modeling preliminary steady state results and proposed experimental tests for code verification are reported.

ABSTRACTS  
GEOPHYSICS LABORATORY

No Abstract Submitted At This Time

Mr. Thomas Kimble

An Investigation of Economic Explosions in Littleton, Massachusetts and  
Healy, Alaska

by

Scharine Kirchoff

ABSTRACT

In an effort to improve the capability to discriminate between seismic sources, economic explosion signals from the San Vel Quarry in Littleton, MA and the Usibelli Coal Mine in Healy, Alaska were selected for this investigation. Using a theoretical modelling technique, based on generalized ray theory, synthetic seismograms were generated. Synthetic wave patterns revealed obscured phase arrivals and increased complexity of the waveforms as the number of shots and delay interval increase. The complexities in the observed and synthetic seismograms may have arisen from propagation path effects and/or effects at the receiver. Recommendations for further investigation of this research effort are discussed.

## Gas Phase Ion-Molecule Reactions of Carbocations

by

Thomas C. Pentecost

### ABSTRACT

In an effort to find and characterize association reactions that proceed via radiative stabilization the reactions of  $\text{CH}_3^+$ ,  $\text{CD}_3^+$ ,  $\text{CF}_3^+$ , and  $\text{CCl}_3^+$  with  $\text{NO}$  and  $\text{SO}_2$  were studied as functions of temperature and pressure. Pressures ranged from 0.3 to 1.0 torr and temperatures ranged from 190K to 470K. The dependence of  $\alpha$  on temperature, pressure, and helium flow was also studied. The results fall into three categories: association reactions, charge transfer reactions, and reactions which do not appear to occur under our experimental conditions. The  $\text{CH}_3^+/\text{SO}_2$  and  $\text{CD}_3^+/\text{SO}_2$  systems were found to give only the association product. The  $\text{CF}_3^+/\text{SO}_2$  system appeared to associate but the data requires further analysis. The  $\text{CH}_3^+/\text{NO}$  and  $\text{CD}_3^+/\text{NO}$  systems were found to charge transfer only. The  $\text{CF}_3^+/\text{NO}$  system appeared to charge transfer but the data requires further analysis. In none of the systems studied was charge transfer with  $\text{SO}_2$  observed.  $\text{CCl}_3^+$  did not appear to react with either  $\text{NO}$  or  $\text{SO}_2$ . Alpha,  $\alpha$ , demonstrated an apparently linear dependence on helium flow. This dependence was found to be much greater than any dependence of  $\alpha$  on temperature or pressure.

ABSTRACTS  
ROME AIR DEVELOPMENT CENTER

## EVALUATION OF SOFTWARE STRUCTURED DESIGNS USING METRICS

by

Richard E. Courtney

### ABSTRACT

A software design history was analyzed using published software design metrics. The evolution of a student software project provided three versions that were studied recording where changes to the design had occurred from one version to the next, the nature of the change and if any software design measures could indicate that a change was necessary. Additionally a new set of design patterns were generated to be studied using the same design metrics. This design set was developed from the same statement of work, but with different data flow diagrams that lead to different designs. Five designs were created but the project time expired before the metrics were calculated. The intuitive feel is that in both cases the metrics are inconclusive about where change is needed and what makes a better design.

Free-Space Laser Communications

Simulator Program

by

Gary A. Hellenga

ABSTRACT

Previously developed mathematical models of the interaction between light photons and natural or man-made atmospheric obscurants were used to predict the extinction of light caused by these particles. The effects of such obscurants acting on a given communications link were combined to determine the amount of light energy received by the collector. System parameters such as collector diameter, laser output power, and internal and exterior noise were then used to determine the overall quality of the simulated link, expressed as a Signal-to-Noise Ratio (SNR).



Dr. Donald Ucci &  
Mr. Robert Petroit

# ABSTRACT

## The Effects of Nonlinearities of High Speed Analog-to-Digital Converters on Digital Beamforming Arrays

Investigation of degradations to digital beamforming arrays caused by nonlinear characteristics of Analog-to-Digital Converters (ADCs) was performed. The study revealed that degradation to the array beam pattern is minimal when only the desired signal is present. However, severe pattern distortion occurred when the signalling environment contained both desired signal and jammer.

These results strongly suggest further investigation into the degradations caused by several jammers and means to counter their effects. Several approaches are proposed to perform these tasks.

Metal Semiconductor Field Effect Transistor Computer Modelling

and

Electron Transport Computation

by

Matthew S. Rubin

ABSTRACT

Alterations in geometries and bias conditions of Metal Semiconductor Field Effect Transistors (M.E.S.F.E.T.) layed out on monolithic microwave integrated circuit chips were experimentally evaluated. To interpret laboratory findings, a computer model was needed. An existing M.E.S.F.E.T. simulation program was refined and modified to meet this requirement. An important modification was the addition of an electron propagation time algorithm that helped analyze M.E.S.F.E.T. behavior.

Noise Calculations in a RADAR Receiver

by

Beryl L. Barber

and

Daryl W. Sprehn

ABSTRACT

The availability of low noise receiver preamps has created the need for a new look at the effective noise of radar receivers. The high cost of low noise amplifiers may not be justified without first considering the effects of other system noise sources more carefully.

The theory and approach for looking at the transmitter and antenna effects on receiver noise are presented. The overall effects of temperature, loss, and VSWR are considered.

ABSTRACTS  
WEAPONS LABORATORY

Mr. Frank Bynum

#### ABSTRACT

Information usable for modeling the IF Flow Tube Experiment was compiled. Species are listed which models should track. Diagrams of energy levels of selected species are given. A number of the important reactions are presented. They are categorized by functional region of the flow tube device, for its current configuration, and for future planned additions.

Greatest level of detail was developed on the temperature dependence of rates pertaining to the generator for dissociated F atoms. Density vs. time curves for this part were calculated, and are shown.

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#### DEDICATION

I would like to express my appreciation of the opportunity to be here and participate in the research activities of the branch. This 10 week session has come to a conclusion all too quickly.

Thanks are extended to:

- Glen Parram, who was the research contact point with whom I interacted most on technical issues;
  - to Bob Crannage, the local contract monitor and my office mate, who shares similar tastes in literature read for enjoyment;
  - Gordon Hager, who said that the literature search would be a major need;
  - Charley Helms, who will be one of the inheritors of copies of the documents stack found and acquired, and who provided me with an early increment to that stack;
  - Richard Kepler, the official AFWL focal point for this AFOSR -UES program;
- the AFOSR and UES organizations, that make this program possible.

#### CATEGORIES of SYMBOLS

The symbols categories used are described here. The principle reason for this is that word processor programs which most of this report were written on don't handle Greek and other math symbols well. Chi-Writer could, and was used to produce a few of the tables and lists. Other cases were spelled out in characters more commonly available on key boards.

$\geq$  greater than or equal

$\leq$  equal or less than

letter ^ number: molecular state designations, name, multiplicity

Stochastic Analysis of Cone Penetration Data

by

Dr.

John J. Cullen

ABSTRACT

Cone penetrometer data from a site containing random spatial variations in soil properties was analyzed for stochastic properties. Techniques of analyzing such properties using the autocorrelation function were considered. Basic design parameters for future site characterization surveys were found. The inhomogeneities were modelled stochastically based on three statistical properties (standard deviation of the variations, and horizontal and vertical scale lengths of the inhomogeneities) using three statistical models (Gaussian, exponential, and Von Karman). Non-random vertical trends in the data were incorporated in the model. Preliminary results indicated a good correlation between the model and data.

Guide for the Diode Laser System to be Used in the Study  
of SO Radical

by

John E. Mccord

ABSTRACT

An experimental system involving an excimer laser, a high resolution tunable diode laser, and a transient digitizer was set up with the intent of measuring the rates of rotational and vibrational energy transfer in the ground electronic state of the sulfur monoxide(SO) radical. The following is a brief experimental description, along with a guideline for the operation of the laser system.

The Experimental Validation of Imaging Correlography Through Atmospheric  
Intensity Scintillations

by

Brian K. Spielbusch

ABSTRACT

Imaging correlography is a technique for obtaining images of laser illuminated objects. This report describes an experiment which was conducted to determine the effect of atmospheric intensity scintillations on images recovered with the imaging correlography technique. The experimental and processing procedures and the experimental results are presented. Also presented are simulation results illustrating the effect that atmospheric scintillation and the camera modulation transfer function (MTF) have on the correlography data and recovered images. Techniques for correcting scintillation and MTF effects are described and results are presented.



ABSTRACTS  
AERO PROPULSION LABORATORY

# An Experimental Investigation of Fractal Surfaces in Turbulent Combustion

by

Jeff Riley

## ABSTRACT

Turbulent jet diffusion flames were seeded with  $\text{TiCl}_4$  vapor which reacted with the water of combustion to form micron size  $\text{TiO}_2$  particles near the reaction zone. The light scattering ability of the  $\text{TiO}_2$  particles is known to decrease rapidly as the temperature of the particles nears  $1,100^\circ\text{K}$ , thus the visual particle seed interface within the flame is expected to roughly follow the  $1,100^\circ\text{K}$  isotherm. This particle seed interface was visualized by pulsing a thin ( $\sim 1$  mm) laser sheet of short time duration ( $\sim 10$  ns) through the jet flame, and recording the reflected light on photographic film. The image of the seed interface was then digitized, thus giving a set of (x,y) data points describing the interface. From this data a measure of the roughness or contortion of the surface was obtained by computing the fractal dimension of the surface using a line-segment length approximation algorithm. From the small sample of flame images analyzed (20), the preliminary results showed that the seed interface (approximate isotherm) was indeed fractal, with an average fractal dimension of approximately 2.4 for high Reynolds number turbulent jet diffusion flames.

ABSTRACTS  
AVIONICS LABORATORY

Thermionic Emission vs Drift-Diffusion and the  
Placement of the Spike Layer for the BICFET

by

John Bambery

ABSTRACT

The analytical program for the BICFET was rewritten in such a way as to allow one to easily change the material system being used and to be able to implement new equations without a significant rewrite of the program. New options were also included in the program.

It was found that the inclusion of all three valleys in AlGaAs was necessary to correctly treat parameters such as the density of states effective mass when the value of the Al mole fraction,  $x$  was around 0.45.

In order to correctly calculate the electron and hole mobilities it is necessary to bring in their dependence on the electric field, the impurity concentration and the Al mole fraction. These changes affected the drift-diffusion velocity and therefore the gain and the current values.

The placement of the spike layer in either the semiconductor or the semi-insulator had a decided impact on the gain and behavior of the device, especially at high values of  $x$ .

At large values of  $x$  the drift-diffusion velocity was dominant and had a profound effect on the gain and the functioning of the device.

# Finite Elements Simulation of the Resonant Tunneling Diode

by

Kevin Lyle Carmichael

## ABSTRACT

At the current time there is a great deal of interest in developing electronic oscillators which can operate in the frequency range above 200 Ghz. It is believed that for a device to accomplish this it must have a region of negative differential resistance. One such device that shows such a region is the resonant tunneling diode. In this project the resonant tunneling diode is investigated to understand the device and to find improvements which could help make the device more applicable.

The analysis of this device is done using a program called SEQUAL. SEQUAL is a finite difference algorithm which was developed specifically to for heterostructure devices. The program self-consistently solves Poisson's equation and Schrodinger's equation to yield information pertaining to the device such as the electrostatic potential, electric field and the electron distribution. The total analysis of this device was completed using information obtained from the SEQUAL program.

# SOFTWARE TOOLS MODELING LOW VOLTAGE BEAM STEERING DEVICES

by

Daniel B. Cook

## ABSTRACT

Computer models of two distinct and promising beam steering devices were performed. The multiple stage Wollaston prism beam steering device, utilizing ferro-electric crystals, was found to give beam steering accuracy within an average of one arc-second. The optical phase array, with its piston and gradient phase array patterns, was also computer modeled, and it was shown that with small enough radiating nematic liquid crystal elements, there is no difference in far-field patterns between the two phase pattern types. A user-friendly computer program was written which transformed wavefront phase patterns into far-field beam patterns.

Edward Grissom

ABSTRACT

ACQUISITION OF DIGITAL RADAR DATA  
FOR USE ON THE IMPROVED ISPX SOFTWARE

The methods used to acquire radar signals in a digital form are explained. A set of programs developed to capture, transfer, and process the digital data are described, along with instructions for their use. Several improvements to the ISPX software are introduced and explained.

Prof. Robert Li, and graduate student Yuhong Li

Model-based Target Recognition Using Laser Radar Imagery

Abstract

Autonomous target recognition can be assisted by using CO<sub>2</sub> laser radar data which contains 3-D information of the scene viewed from the sensor. Using efficient image processing algorithms such as the Hough transform, the orientations and dimensions of the target can be calculated. This information then can be used by a model-based recognition system to identify the target. The identification is based on an inference procedure which tests hypotheses using the available evidence from the sensory data.



# A PROPOSED TURBULENCE MONITORING FACILITY FOR WRIGHT-PATTERSON AIR FORCE BASE

by

Randal L. N. Mandock

## ABSTRACT

A study was undertaken to develop a plan for the characterization of atmospheric turbulence to support infrared sensor and laser beam propagation research at Wright-Patterson Air Force Base. To accomplish this assignment, I: surveyed the topography and physical environment of the AFWAL test range in Area "B"; visited the NOAA Wave Propagation Laboratory in Boulder, Colorado, and the Georgia Tech Research Institute at Georgia Tech, Atlanta, Georgia; and wrote three proposals to monitor atmospheric turbulence.

The facility proposed in this report is designed to monitor turbulence during routine testing and special experiments. This facility is expected to provide information on the behavior of the refractivity structure parameter along a slant-path propagation range and at a well-characterized horizontal propagation range on Wright Field.

Lightwave Systems and Device Database Development

by:

Phillip E. Pace

ABSTRACT

Conventional receiver architecture and signal processing techniques are reaching their limits in terms of speed and throughput and new optical designs are offering great promise in terms of these eliminating these limitations. Lightwave system designers are now faced with the problem of staying abreast of the current and future state of optical devices and sub-system technologies. A composite, categorized, and up-to-date database development has been researched and constructed which details the various optical computing and processing components available for systems development along with a brief description of their general capabilities.

# A Study of Sky Backgrounds and Sub-Visual Cirrus

by

Eric O. Schmidt

## ABSTRACT

A complementary set of instruments was set up to facilitate the observation of natural sky background radiance levels and the detection of sub-visual cirrus clouds Wright-Patterson Air Force Base. Two coordinated camera/photometer systems were used to look at the solar aureole and at the sky background. A frequency-doubled Nd:Yag lidar was used for sub-visual cirrus detection and the other instruments coordinated with synoptic data to try to characterize the clouds.

Sub-visual cirrus were detected on the afternoon of the final day of the experiment in a band ahead of a cold front. The detection of the incidence and continued presence of an optically thin, yet physically thick smoke layer due to forest fires in the northwestern U.S. was a bonus for the experiment. The natural photometric background levels were determined for a variety of weather conditions and the range, resolution and photon noise levels measured.

ADAPTIVE ARRAY ARCHITECTURES with LOW-SENSITIVITY TO  
RANDOM ERRORS IN THE STEERING VECTOR ELEMENTS

by

Tien N. Tran

ABSTRACT

Adaptive Arrays and Beam Forming are used extensively to enhance a desired signal and adaptively cancel or null jammers and other interfering signals. In adaptive processing using the Applebaum adaptive array approach, a steering vector is used to steer the array in the direction of the desired signal. It has been shown by Compton, Jr. that errors in the steering vector elements can cause a rapid drop in the output signal-to-interference-plus-noise ratio (SINR) and that the drop becomes larger as the number of elements in the array is increased. In this report, we show that the sensitivity of the output of the array processor to errors in the steering elements can be minimized by going for alternate architectures. We also point out other advantages of such architectures.

## Extraction of Circuit Definitions from VHDL Specifications

by

John P. Van Tassel

### ABSTRACT

The report that follows is a discussion of the results of the research conducted under government contract project # 210, contract number F49620-88-C-0053 on the formal verification of digital circuit designs specified in the VHDL description language. It describes a method of logic extraction using executable Prolog grammars, and the extensions of such a scheme to mechanical theorem proving. The work included here was conducted in cooperation with Dr. David Hemmendinger, and should be viewed in conjunction with his report.

APPLICATIONS OF EVOLUTIONARY LEARNING STRATEGIES  
TO PATTERN RECOGNITION TASKS

by

Mateen M. Rizki  
Louis A. Tamburino  
William VanValkenburgh  
Michael Zmuda

ABSTRACT

A software environment was developed to study learning strategies applied to tasks in image processing. This environment facilitates the systematic exploration of evolutionary learning processes and embedded adaptive control mechanisms that modify both feature extraction and image classification tasks. The feature detectors were constructed as Hit or Miss templates based on principles of mathematical morphology. This representation provided a suitable substrate for the gradual changes introduced by evolutionary learning algorithms. The software package was used to conduct experiments on a two-class character recognition problem. These preliminary experiments illustrate the importance of incorporating adaptive learning mechanisms in image processing systems.

ABSTRACTS  
FLIGHT DYNAMICS LABORATORY

A Computer Model for Air-To-Air Combat

(Force on Force) Assessment

by

Patrick J. Sweeney, Ph.D.

Kathy Bennett, Grad Student

ABSTRACT

This IBM-PC compatible computer model can be used to assess the affects of changing weapons, aircraft performance, electronic sensors and countermeasures, situational awareness, tactics, observables, and combat support on the force on force air battle. Both enemy and friendly air forces can engage in both BVR and CIC missions. Sortie regeneration is limited by the air losses and by enemy action taken against fixed installations, which is included in the model. The model requires a hard disc for operation and uses menus to direct the user to battle graphics, forces structuring, calculations, and output to the screen and/or printer.



EVALUATIONS OF SUBOPTIMAL FILTERS AS RELIABLE  
LARGE FLEXIBLE SPACE STRUCTURES

by

Susan M. Dumbaugh

ABSTRACT

With the reality of space existence so near at hand, it is imperative that man keep up with the technology required to achieve these lofty goals. With this in mind, the topic of structural control of Large Flexible Space Structures (LFSS) is indeed an important one. To separate the fields of structures and controls in this case would be to ignore the problem as a whole and, hence, it is desired to effectively control a LFSS with the minimum structural weight required. From this standpoint, various parameters of the LFSS and, in particular, modal positions and velocities, must be determined to utilize effective feedback control to damp out unwanted vibrations. The purpose of this study is to evaluate the possible types of estimation of these modal positions and velocities and, specifically, to investigate the performance and robustness of suboptimal/decentralized filters as opposed to centralized filters.

No Abstract Submitted At This Time

Mr. Bryon Foos

DEVELOPMENT OF AN AIRCRAFT TIRE-WHEEL INTERFACE MODEL  
FOR FLANGE/BEADSEAT CONTACT LOADS

by

James A. Sherwood

N. Christopher Holmes

ABSTRACT

A research program has been initiated to investigate the force distribution at the interface of an aircraft wheel and tire. An F-16 main wheel was instrumented with strain gages at ten critical structural points. Test data were recorded for bolt torque, inflation pressure, vertical static and dynamic load conditions using both radial and bias-ply tires. A detailed three-dimensional finite-element model of the wheel was generated for evaluation via the ADINA finite-element code using the ADINA-IN preprocessor. An analytical technique of using influence coefficients determined from the finite-element analysis was devised to backcalculate the tire-wheel interface load distribution from the experimental data.

A FLIGHT CONTROL RECONFIGURATION STUDY  
USING MODEL REFERENCE ADAPTIVE CONTROL

by

William D. Morse

The Ohio State University

Department of Electrical Engineering

Columbus, OH 43210

ABSTRACT

A simplified multivariable model reference adaptive control (MRAC) is shown to provide control reconfiguration for the AFTI/F16 during single, double, triple, and quadruple control surface failures. The simplified MRAC is unique in that it may employ a reduced order model and is applicable to unstable nonminimum phase plants. The MRAC is capable of implicitly redistributing the control effort among the aircrafts effective surfaces without explicit knowledge of the failure. The resulting control reconfiguration forces the aircraft to approximate the reference model trajectories. The AFTI/F16 model used for simulations incorporated the nonlinear rate and saturation limited servo dynamics.

DAMAGE IN GRAPHITE/EPOXY PLATES SUBJECTED TO LOW VELOCITY IMPACT

by\_

William E. Wolfe

Gregory Schoeppner

ABSTRACT

A continuation of the experimental program begun during Summer 1987 was conducted. Instrumented impact tests on laminated graphite/epoxy panels. The velocity of the impactor and the load time history were recorded for each specimen tested. In several tests, strains were measured on the back face during the impact event. The depth of surface indentation and the areal extent of internal damage were measured and correlated with the impact energy. Predicted strains in the outermost ply were compared with experimentally obtained values measured both perpendicular to and in the direction of the outermost fiber. The amount of internal damage and the indentation were found to be dependent upon the energy at impact and to a somewhat lesser degree on the velocity of the impactor. The shape of the damaged area in the specimens tested, was largely dependent upon the thickness of the panel and the location of the supports.

FINITE ELEMENT ANALYSIS FOR PRELIMINARY  
STRUCTURAL DESIGN/OPTIMIZATION

by  
Richard A. Swift

ABSTRACT

Finite element analysis for use in structural design has advanced to the point where multidisciplinary analysis and design capabilities are well supported by a number of programs. These codes offer unique possibilities in terms of minimizing the time required at the preliminary design stage. Investigations into the theoretical and operational aspects of ASTROS (the Automated STRuctural Optimization System) for its use in preliminary design have supported proposed research into this area at the University of Notre Dame.

Optimal and Sub-Optimal Loop Shaping

in

Quantitative Feedback Theory

by

David F. Thompson

ABSTRACT

The motivation for the development of loop shaping algorithms in the Quantitative Feedback Theory (QFT) method for control system design is discussed, and the conclusions of preliminary research is presented. After a brief introduction and problem statement, basic issues critical to the successful implementation of the QFT method are outlined, followed by a discussion of the benefits an automated loop shaping procedure would afford. Specific results of investigations during the summer research period are presented, and criteria for the evaluation of candidate algorithms to be developed in subsequent work are discussed.

ABSTRACTS  
MATERIALS LABORATORY



PHOTOREFLECTANCE AS A CHARACTERIZATION TOOL  
FOR GALLIUM ARSINIDE AND ALUMINUM GALLIUM ARSINIDE MATERIALS

by

James E. Angelo

ABSTRACT

Modulation Spectroscopy<sup>1,2</sup> and Electroreflectance (ER) in particular have been used extensively to characterize semiconducting materials. Photoreflectance (PR), a contactless form of ER, is being realized as a method of characterizing semiconductors nondestructively. This paper shows that PR allows for quick determination of the band gap energy, and doping level in Gallium Arsinide (GaAs). It also allows for the determination of alloy composition of GaAs/Aluminum Gallium Arsinide ( $\text{Al}_x\text{Ga}_{1-x}\text{As}$ ) quantum wells.

# ANALYTICAL AND NUMERICAL SOLUTIONS OF THE NON-LINEAR DIFFUSION EQUATION

by

Darwin L. Boyd

## ABSTRACT

Using an approximate analytical solution, zeroth and first order correction terms of dopant concentration profiles were calculated for several special cases of concentration dependence of diffusivity. The three cases of the dependence studied were  $D=D_0C^v$ ,  $D=D_0\exp(kC)$ , and  $D=D_0\sinh^2(kC)$ . These were compared with numerical results obtained from a forward time centered space (FTCS) differencing of the nonlinear diffusion equation. Close agreement was obtained for some cases indicating that the analytical approach may be an attractive alternative to the central processing unit intensive numerical integration of the dopant diffusion equation.

## QPA Control of the End Milling Process

by

Dr. B.K. Fussell  
and Doug Gagne

### Abstract

Qualitative Process Automation (QPA) control was applied to the end milling machining process to maximize feed rates while avoiding unwanted cutting events such as excessive tool deflection, tooth overload and cutter shank overload. QPA controlled the process actively by achieving desired events and preventing undesired events. QPA is a real-time controller with its control output based on process events and not on temporal relationships as are classical control systems. Various procedures for detecting machining events with sensor data were investigated and used with an existing QPA computer structure to develop a controller for the end milling process. The QPA controller used cutting force, spindle speed and feed rate data to predict and avoid excessive tool and tooth loads and to maintain part tolerance with the highest feed rate. Simulation cutting results, using an experimentally validated end milling model, showed the QPA system to be successful in controlling end milling cuts. Successful simulation runs were demonstrated for step changes in the radial and axial depths of cut on aluminum workpieces.

Can Design For Extruded Powder Metallurgy Materials, and the  
Effects of Can Geometry and Can Material on the Powder  
Metallurgy Material Core.

by

Robert L. Goetz

ABSTRACT

The objective of this project was to examine the effects of "can" thickness and "can" material on the state of stress and the uniformity of the velocity field for the co-extrusion of a "canned" P/M material. The process was simulated as isothermal using the FEM code MME-ALPID. Three can thicknesses were simulated; 1/8", 1/4", and 1/2". The P/M material used was IN100, and Austenitic Stainless Steel was used for the "can" material. Simulations proceeded to the point where the nose cap was extruded before remeshing was required. Initial results show that the 1/8" can will possibly fracture. The 1/4" can has a more uniform deformation than 1/8" can. No conclusions have been made about the 1/2" can as yet. The stress ratio of  $\sigma_m/\bar{\sigma}$  in the 1/4" can shows a transition from compressive to tensile stresses near the die exit. It is recommended that, in addition to the present simulation, a non-isothermal simulation using ALPID be made, and that ALPIDP be used for a comparison. These projects would ultimately aid in the "can" design for any P/M material.

## INTERFACE RESISTIVITY MODELLING OF THE HOT ROLLING OF Ti-48Al-1V

by

Andrew E. Hensley

### ABSTRACT

In order to obtain computer simulations of the gamma titanium aluminide hot rolling process using finite element modelling, it is necessary to gather data on the interface properties between the TiAl workpiece and the TZM molybdenum rolls. One of these interface conditions which needs a great deal of further investigation is the coefficient of electrical resistivity between these two materials. In order to accomplish this, test methods and procedures must be established. Also, there needs to be a great deal of microstructural work done with gamma titanium aluminide in order to gain insight into its characteristics during processing.

Phase Relationships in Al-Nb-X Ternary Alloy Systems

by

J.P. Simmons

ABSTRACT

Samples of Al-Nb-Mo, Al-Nb-Co, and Al-Nb-Cr were heat treated and examined with microprobe and X-ray diffraction analysis in order to determine whether or not any  $L1_2$  compounds form in the ternary systems. It was found that no  $L1_2$  ternaries were formed as a result of substitution for the Al by the elements Co and Cr at 1200°C and 1300°C, respectively. Preliminary information indicated this to be the case with Mo at 1400°C as well. From the samples examined, it was not possible to determine whether or not any  $L1_2$  phases formed as a result of substitution for Nb. Preliminary evidence of an unreported phase in the Al-Nb-Mo system was found. It was also found that Mo was the only one of these that dissolved to any extent in the  $DO_{22}$  phase. Some phase diagram data were generated. Recommendations were made as to completion of work in these systems, procedural changes, and the applicability of the Pettifor scheme as a predictive tool.

Design of mechanical joints and their implications to the  
implementation of a comprehensive computer aided design  
package.

by

David A. Swick

ABSTRACT

The topic of this paper is to determine the kind of knowledge needed to implement a comprehensive computer aided design package. The design is comprehensive in the sense it gives the designer support, from the conceptual through the final stages of product development. The biggest benefit of a comprehensive design package, is it gives the human designer immediate feedback on the choices being made concerning the designed product. It is proposed that a comprehensive computer aided design tool, could help the human designer produce designs that are more cost effective as well as manufacturable.

In order to demonstrate what mechanical engineering knowledge is needed, for a comprehensive design system, a small test program has been written to aid the designer in the selection of joining processes. The program will help the designer in crossing technological domains, that he or she might not otherwise consider as a possible design option. This hesitancy to cross domain boundaries may be due to a lack of familiarity with characteristics involved in an unknown area of expertise.

THE STUDY OF TRIMETHYLSILYL POLYPHOSPHATE (PPSE) AS A  
DEHYDRATING AGENT FOR POLYMERIZATIONS AND MODEL COMPOUND  
PREPERATIONS OF N-PHENYLBENZIMIDAZOLES

by  
Ronald C. Tomlinson

ABSTRACT

The dehydrating agent Trimethylsilylpolyphosphate (PPSE) was employed in a one step synthesis of N-Phenylbenzimidazoles. Model compounds produced from this agent are 2,2'-(1,3-phenylene)bis(1-phenylbenzimidazole) and 2,2'-(1,4-(2,5-didecyloxybenzene))bis(1-phenylbenzimidazole) from a TBOC derivative of N-Phenyl-1,2-phenylenediamine and the corresponding dicarboxylic acid in near quantitative yields.



No Abstract Submitted At This Time

Ms. Deborah Vezie

Effect of Various Metals on The Thermal Degradation of  
A Chlorotrifluoroethylene Based Fluid

by

Vijay K. Gupta and Oden L. Warren

ABSTRACT

Thermal stability characteristics of a chlorotrifluoroethylene (CTFE) basestock candidate nonflammable hydraulic fluid, MLC 86-7, have been investigated as a function of time and temperature via micro-thermal stability tests in the presence of various metal powders and alloys. It has been found that this fluid is a complex mixture of chlorofluorocarbon compounds. The fluid was found to be thermally stable when stressed for 22 hours at 232°C or below, but when stressed at temperatures above 232°C, degradation was observed, and the extent of degradation increased with increasing stress temperature. The fluid degraded severely when stressed at 302°C for 66 hours. When the fluid was also stressed at 177°C for time periods ranging up to 40 days in the presence of alloys or metal powders, some degradation of the fluid was observed. At 177°C, the presence of Cu in the fluid caused more degradation as compared to other metals and alloys, and the degradation was further accelerated by the presence of water. At 302°C, the elements Cu, Fe, Sn, and Ti seem to have accelerated the degradation of the CTFE fluid whereas elements like Al, Co, Cr, Mn, Ni, W, and Zn do not seem to have any significant impact on the degradation of the CTFE fluid. The increase in acidity of the fluid caused by thermal degradation processes at temperatures much higher than 175°C (anticipated maximum use temperature) in the presence of metals and moisture produces corrosive products.

ABSTRACTS  
HARRY G. ARMSTRONG AEROSPACE MEDICAL RESEARCH LABORATORY

Improvements in the Control of Robotic Arm Simulations  
Using the Articulated Total Body (ATB) Model

by

Daniel William Barineau

Abstract

Modifications were made to the control of torque generation in the Air Force's ATB model. Improved controller feedback was created by adding an integral control term to the existing control equation. Motion studies were performed using a Merlin robot simulation to determine control variables for single joint rotations. A joint rotation range from -180 degrees to +180 degrees was examined.

Values determined from the above study for the six joints in question were added to the input description as a tabular set of data, which the computer could access depending on the joint target angles set by the operator. Simultaneous multi-joint rotations were also studied using the same controlling values as were used in single joint rotations. It was found that these numbers produced accurate results for all joint rotations, as long as either the shoulder or elbow joints were held at their initial angular positions. The error produced when the target angles for both the shoulder and elbow were non-zero was less than two degrees of arc. This problem can be overcome by modifying the control equation with some function of the robot's inertial properties.

## Auditory Modeling

by

C. David Covington

and

Michael K. Ellis

### ABSTRACT

Several promising auditory models exist as reported in the literature, but they execute in different systems. We have ported two of three chosen auditory models to the Symbolics lisp machine. This affords the advantage of direct comparison of output and permits a more modular approach to the auditory modeling problem. In addition with all models residing in the powerful rapid-prototyping lisp environment, the researcher can then conveniently apply model output to either conventional pattern recognition algorithms or to more recently introduced simulated neural network systems. This report also discusses our efforts to develop a programming environment suitable to implement the more promising neural network approaches as means of modeling postprocessing by the brain on auditory periphery output in the human.

Performance in a Visual Monitoring Task  
with Serial and Simultaneous Display Formats

by

David G. Payne  
Virginia Gunther

ABSTRACT

Thirteen adults monitored either four or eight sets of three-digit numbers that appeared on a computer monitor. These stimulus items were labelled with an uppercase letter A - H and each stimulus was paired with a unique response key. The stimulus values were periodically incremented or decremented and the subject's task was to respond whenever a value exceeded a prespecified limit. In the simultaneous condition, all four (or eight) number-letter combinations were presented concurrently in spatially distinct locations. In the serial condition, each item was presented individually in the same central location .8 seconds and was then replaced by the next item in sequence. Results showed that subjects responded more quickly in the serial condition than in the simultaneous condition. Although subjects made more errors in the serial condition, these error rates did not increase across trials, even though the reaction times improved. These results indicate that the rapid serial presentation format has the potential for yielding better performance in visual supervisory monitoring tasks than does the conventional (i.e., spatially distributed) display format.

EVALUATION OF THE TOXIC EFFECTS OF A 90-  
DAY CONTINUOUS EXPOSURE OF RATS AND  
TO SHALE DERIVED JP-4 JET FUEL

by

Stephen R. Jenei

ABSTRACT

Many volatile hydrocarbons are widely used as additives in jet and automobile fuels. JP-4 is a complex mixture of aliphatic and aromatic hydrocarbons with various additives and is used as a fuel additive. This investigation looked at the effects of JP-4 on the kidneys and livers of Fischer F344, male rats. Sections of kidneys containing the glomeruli were processed and sectioned for transmission electron microscopy (TEM). Also, as part of the summer program, tissues collected from ALCAP implantable ceramic drug delivery capsules were obtained from animals implanted for three months and examined for inflammatory and immune response. A new procedure utilizing scanning electron microscopy for examination of spermatozoa was also developed for the Air Force.

Elizabeth Kavran

CERAMIC COMPOSITE MATERIALS FOR ESTABLISHING  
INGROWTH OF BONE AND DEVELOPING  
BONE REMODELING MODELS

ABSTRACT

The primary objective of this study was to prepare a Tricalcium Phosphate (TCP) bone composite. X-ray diffraction analysis confirmed that the aqueous precipitation and sulfate catalysis procedure employed in this investigation yielded 100% pure TCP. This investigation also looked at the setting properties of different TCP and polyfunctional acid composites. Results obtained indicated that addition of malic acid to TCP yielded the best composite. This composite set and hardened within 15 minutes. The pH studies confirmed that a TCP composite with malic acid and calcium hydroxide on dissolution maintain an alkaline pH. The effect of implanting an ALCAP, malic acid and calcium hydroxide composite on the blood profile of rhesus monkeys was also observed in this investigation. The data obtained showed that the composite implants did not change the blood chemistry profile of the rhesus monkeys.



# VISUAL-SPATIAL LOCALIZATION WITH A HELMET-MOUNTED DISPLAY

by

Richard J. Kunze

## ABSTRACT

An experiment to investigate design factors and performance factors involved in the development of helmet-mounted displays and the ability of humans to locate objects in virtual space yielded three major findings. (1) The number of targets displayed (3, 6, or 9) played a significant role in the subjects' ability to remember target locations, with subjects decreasing in accuracy as the number of targets increased. (2) Properties of initial location of targets in virtual space (e.g. elevation) explained a significant proportion of target replacement error. (3) The size of the helmet-mounted display field-of-view affected subjects' ability to search for and find targets.

ABSTRACT

Evaluation of an Extraction Procedure  
for the Analysis of Serum Steroids

by

Dr. Robert E. Masingale

and

Deborah J. Mitchell

ABSTRACT

Two methods are described for the screening, extraction and confirmation of the free and conjugated steroids in rat serum. It was demonstrated that a liquid-solid extraction technique combined with a three-solvent extraction system allows for more expedient sample preparation of the steroids. These methods were evaluated by screening for the presence of the following from sera: (1) androstenedione, (2) corticosterone, (3) estradiol, and (4) progesterone. Gas chromatographic/mass spectrometric analyses of the derivatized products were performed to evaluate the two procedures.

# NEPHROTOXICITY OF 2,5-DMH IN FISCHER 344 RATS

by

Jacqueline Roberts

## ABSTRACT

2,5-Dimethylhexane (2,5-DMH) was studied as a potential carcinogen in Fischer 344 rats. This was carried out using rats dosed with 2,5-DMH and collecting the urine after a 48 hour period. Analysis via gas chromatograph and gas chromatograph/mass spectrometer produced two unidentified peaks which were established as metabolites produced by these rats. These metabolites were identified by comparison of purchased and synthesized chemicals. With the knowledge of these identified metabolites it was then hoped to determine if structures of these metabolites induced the nephrotoxicity found in these animals.

Physiological Measures of Workload

During Actual Flight

by

Christopher Sullivan

Abstract

Five physiological measures of workload--heart rate, respiration, eye-blink, electroencephalogram and event-related brain potential--were recorded from ten experienced F4 attack aircraft crews. Each crew flew the same air-to-ground practice maneuver in the wing position of either a two-ship or four-ship formation. Each mission was comprised of low level terrain following, high G maneuvers, bombing runs, a high altitude cruise to base, and a formation approach ending in single-ship landings. A preliminary analysis of the data indicates that ERPs can be a useful measure of workload in this exceedingly complex and noisy environment. Preliminary analyses on the remaining measures have not been completed.

Ground-Texture Information for Aimpoint Estimation

by

Lisa F. Weinstein

ABSTRACT

This experiment examined the effects of ground texture on aimpoint estimation in a landing-judgment task. Subjects viewed a simulated landing approach which stopped "in midair". Subjects were asked to estimate the point at which they would land if they continued on the current path. Results indicate that structured texture, and expanding texture elements improved performance. Furthermore, with dot patterns, performance was better when the aimpoint was represented by a specific point on the display.

ABSTRACTS  
HUMAN RESOURCES LABORATORY

## The Relationship between Inspection Time and Intelligence

by

Robert K. Young

and John Allison

### ABSTRACT

The relationship between inspection time and intelligence was investigated using a relatively homogeneous population: Air Force recruits. Inspection time is defined as the minimum time necessary to see a difference between two or more items. In the usual task, two lines are presented for an extremely short duration and the task of the subject is to indicate which of the two lines is shorter. Previous research was replicated using a relatively large sample size ( $N = 113$ ).

Consistent with previously reported studies, a correlation between inspection time and the Cattell Culture Fair Test, the measure of intelligence employed, was found for the entire sample ( $r = 0.34$ ). Additional analyses indicated that some subjects used an apparent movement strategy. For those subjects no relationship was found between measure of intelligence and inspection time ( $r = 0.21$ ). But for those subjects who did not use a strategy, a relatively high correlation was found ( $r = 0.56$ ) between inspection-time performance and our measure of intelligence. However, no mean difference in inspection time was found between the strategy and non-strategy groups. Nor was there any mean difference found between the strategy and non-strategy groups in the measure of intelligence employed.

EFFECTIVENESS OF CONTRACT MONITORS IN AN AIR FORCE  
HUMAN RESOURCES LABORATORY: PREDICTION AND MEASUREMENT

by

L. Alan Witt, Ph.D

and

Mark N. Beorkren

ABSTRACT

Facing decreasing operating budgets, Air Force R&D laboratories must increase the productivity of their human resources in order to maintain expected levels of performance. As a step toward that end, the multivariate study partially described in this report was designed to identify individual and situation-level factors that are related to the effectiveness of contract monitor/researchers at the Operations Training Division of the Human Resources Laboratory at Williams AFB, Arizona. Effectiveness criterion data were collected from managerial ratings, organization archives, and questionnaires administered to the contract monitors/researchers. The cognitive and affective reactions of personnel to their work environment were assessed by interviews and the above-mentioned questionnaire. Results indicated several perceptual/affective and behavioral predictors of effectiveness.



No Abstract Submitted At This Time

Ms. Patricia Cooper

# An Intelligent Tutor for the IBM System/360 Assembly Language: BIGBLUE

by

Sunita S. Rana &  
Charles Drake

## ABSTRACT

The Air Force Human Resources Laboratory (AFHRL) at Brooks Air Force Base in San Antonio, Texas is a major research center for developing Artificial Intelligence (AI) and ways in which to utilize this intelligence for the military. There is a need to supplement or replace a shrinking pool of human Air Force instructors.

Assembly language is taught at the Air Force Technical School and also as a part of the CDC 49152 for Information Systems Programming Specialist in the Air Force. The IBM system 360/370 mainframe is the hardware most commonly found at Air Force installations. During my summer research here, an attempt was made to develop an Intelligent Tutoring System (ITS) for the IBM 360/370 Assembly Language. Thus far, all ITSs in the computer programming area have been attempted for high-level languages (frequently Pascal). It was a challenge to develop one for a low-level language. Low-level languages are machine dependent and more difficult to code, as each instruction directly manipulates hardware of the machine. Assembly language is more a tool to teach computer architecture than programming style. Therefore, an ITS on assembly language requires an explanation in tandem with each instruction of the hardware basis for doing so. This is also a required language for graduate and undergraduate students at Jackson State University. The tutor was named BIGBLUE for IBM's System/360.

Underlying Distributions of The New PACE Variables

by

Peter Gaddis, Jr.

ABSTRACT

This study investigated the underlying distributions of the variables in the payoff algorithm in the new PACE system. The results from the goodness-of-fits test indicated that only one variable- "objective interest", seems to follow a normal distribution in all three batches of recruits included in the analysis. Some of the other variables were found to follow a normal distribution in one batch and a non-normal distribution in the remaining batches of recruits. To assess interaction between job properties and individual characteristics in the new PACE system, intracorrelations among payoffs of various jobs in the Administrative area of a week group were computed for a particular group of the Air Force trainees. The payoffs of only one out of eight jobs in the Administrative area of a week group were negatively correlated. In addition, data analysis involving application of general linear model was performed to assist Dr. Rana in analyzing interaction in the new PACE system.

Development of a General Reliability  
Simulation Model

by  
Charles L. King

ABSTRACT

Recent advances in the capabilities of discrete-event simulation permit the development of a general simulation model to assist design and test engineers in the assessment of reliability. The process-oriented, discrete-event simulation language SIMNET allows the programming flexibility necessary to model any system whose component relationships can be represented by a functional block diagram. Alternative designs are modeled simply, by changing initial data entries to the model. The model was applied to an actual case study: the F-16 voice communications system. F-16 engineers assisted in development of the system functional block diagram and provided actual field reliability data (mean flight hours between failure), for the line replaceable units (LRU's). Upon complete development, this model will interface with an expert system.

Development of a Candidate Taxonomy for  
Air Force Enlisted Specialties

by

David L. Mayfield

ABSTRACT

Principal Component Analysis was conducted on the General Work Inventory and the Electronic Principals Inventory toward developing a taxonomy of tasks performed by USAF personnel. One of the primary purposes of the taxonomy is to permit the assessment of similarities between the job requirements across different Air Force specialties. Results from several analyses, along with input from AFHRL Scientists resulted in a 26-category candidate skill/task taxonomy. Definitions of the categories, comparisons between this candidate taxonomy and other taxonomies, and practical uses of this taxonomy are presented. The candidate taxonomy needs to be validated in terms of its ability to support accurate cross-AFS ease of movement predictions.

FORM DISTORTIONS IN COMPUTER GENERATED MOVING OBJECTS:  
AN ASSESSMENT OF DISPLAY PARAMETERS.

Jerome Nadel

ABSTRACT

A study is reported that assessed the computer display parameters that yield systematic form distortion of computer generated small moving objects. Lindholm (1988) reported that an interlaced display with a 30 Hz update rate produced systematic form distortion as a function of object speed and direction of motion and line written first. The present study extended the Lindholm (1988) paradigm, testing predictions concerning the rate of movement of the object and presentation duration. We found that (a) the direction of distortion could be predicted by the line written first (top vs. bottom), (b) the magnitude of distortion could be predicted by the object speed, and (c) the reliability of the perceived distortion could be predicted by the presentation duration.

# OCULAR MOTOR RESPONSE TO SINUSOIDAL STIMULI

Peter Pidcoe

## ABSTRACT

A linear systems approach was taken to characterize the frequency response of the oculomotor system to a variety of horizontally tracked targets. The applied stimulus included single frequency sinusoids ranging in frequency from 0.1 Hz to 2.0 Hz and a random stimulus composed of six non-harmonically related sinusoids. The amplitude of all stimuli was  $\pm 2$  degrees.

A discrete Fourier transform analysis (DFT) was performed on the sample population response at each frequency using the Chirp Z-transform algorithm (Rabiner, et al., 1968). The magnitude components from each response DFT were compared to actual components of the stimulus. Plotting the amplitude ratios of the single frequency stimuli provided a characterization of the frequency response of the oculomotor system. The amplitude ratios for the random stimulus were also computed and compared to the single frequency responses.

## AIR FORCE TRAINING EVALUATION SYSTEM: A CASE STUDY

by

Douglas J. Sego

### ABSTRACT

The Instructional Systems Development (ISD) model used by the Air Force specifies a link between the training evaluation phase and the needs reassessment phase. This linkage is examined using the Aerospace Ground Equipment (AGE) career field Airman in Basic Residence (ABR) technical training course as a case study. Several sources of information were used in developing this case study. They are listed along with a description of the information they contain. How the evaluation system answers the question of content validity and over- or undertraining of the AGE ABR course is examined. The key issues are the matching information from two domains, such as the job and training content domains, and the level of specificity of that information. Limitations of the evaluation system are provided as well as future research directions.



ABSTRACTS  
OCCUPATIONALAL AND ENVIRONMENT HEALTH LABORATORY

Evaluation of T-9 Noise Suppressor System at McConnell AFB, Kansas

Phyllis Keys

ABSTRACT

This report presents the topics of research studied during the Graduate Student Research Program which include the following: the effects of noise on humans, effective methods of measuring the noise and its effect, a description of a T-9 Noise Suppressor System, and a description of an experiment measuring nitrous oxide leakage in dental masks. Also included is sample output of a noise measurement from the T-9 Noise Suppressor System (T-9NSS) at McConnell AFB. Recommendations which should improve the quality of work at the laboratory in which I worked, as well as recommendations for the Research Program, are made at the end of this report.

ABSTRACTS  
SCHOOL OF AEROSPACE MEDICINE

No Abstract Submitted At This Time

Mr. John Barnaby

No Abstract Submitted At This Time

Mr. Otis Cosby

Jerry Dillon

STANDARDIZATION OF DAIM PRECIPITATE

Abstract

DALM (Diazoluminolmelanin) a luminol derivative has recently been discovered. This presentation marks the initial quantitating for this oxidize free radical scavenger in the presence of  $H_2O_2$  and HRP (Horseradish Peroxidase). Quantitation results are compared to the mother compound luminol as a means to gauge efficiency of use.

MEMBRANE ALTERATIONS INVOLVED IN EVOKED RELEASE  
OF L-GLUTAMIC ACID  
FROM MOSSY FIBER SYNAPTOSOMES

by

Ernest J. Freeman

ABSTRACT

Mossy fiber synaptosomes were isolated from both hippocampal and cerebellar tissue obtained from 200-300 gram male Wistar rats. The synaptosomal preparation was applied to filters supported in incubated superfusion chambers. The preparation was kept covered continuously with appropriate buffer while fractions were collected at a rate of 0.5 ml/min. After fractions were collected they were frozen and lyophilized. The fractions were later reconstituted and assayed for the presence of L-glutamate using an enzyme coupled reaction in a fluorescence spectrometer. This allowed us to determine the stimulatory and inhibitory actions of various agents on the release of this acidic amino acid neurotransmitter from the mossy fiber synaptosomes.

Development of Improved Assays for Cholesterol and  
Major Lipoprotein Fractions

by

Eric R. Johnson, Ph.D., and Thomas E. Lane

A sensitive method suitable for the analysis of subnanogram amounts of cholesterol by electron capture gas chromatography has been developed. The method involves extraction of cholesterol and cholesterol esters from saliva or urine followed by hydrolysis and derivatization with 2,3,4,5,6-pentafluorobenzoyl (PFB-) chloride. The yield of the PFB-esters of cholesterol and the internal standard epicoprostanol was in excess of 99%. The method has a lower limit of sensitivity for cholesterol of approximately 500 pg injected, which corresponds to 250 ng per mL of saliva or urine. The coefficient of variation for the extraction and analysis of cholesterol from urine samples was found to be 4.2% (cholesterol concentration 570 ng/mL). This method, which is approximately 1000 times more sensitive than gas chromatographic methods utilizing flame ionization detection, is applicable to the analysis of non-esterified cholesterol and total cholesterol (cholesterol plus cholesterol esters) in saliva and urine.

Development of an improved high performance liquid chromatographic assay for the major lipoprotein fractions in serum was also initiated. A system comprised of three size exclusion columns linked in series was found to give good resolution between low density lipoprotein, high density lipoprotein, and albumin.



GLAUCOMA IN US AIR FORCE AVIATORS-  
USAF SCHOOL OF AEROSPACE MEDICINE STUDY GROUP

BY

Yolanda A. Malone

ABSTRACT

A retrospective study was conducted on approximately 125 United Air Force Pilots diagnosed with glaucoma. Pilots were followed over a course of ten years. The developed protocol focused on glaucoma with regard to epidemiology, treatment, and aeromedical disposition. In addition the effects of medication and progression of various parameters such as: cup/disc ratio, visual field change and intra-ocular pressure ranges were examined. The data collected indicated a positive correlation between factors such as trauma, steroid use and heredity to glaucoma. There were few cases of treatment by laser trabeculoplasty, but in cases where this type of treatment was necessary the pilots were usually grounded. Pilots retaining flying status were controlled on medication. Patients with pigmentary dispersion glaucoma were excluded from this study.

THE SEPARATION OF HDL2 AND HDL3  
USING THE TECHNIQUE OF ULTRACENTRIFUGATION

by

Joe M. Ross  
Conrad Murray  
ABSTRACT

A Beckman TL100 ultracentrifuge fitted with a TL55 swinging bucket rotor was used to:

- (1) separate whole serum into two fractions - one containing both LDL and HDL and one containing the remaining serum proteins;
- (2) separate whole serum into four fractions - one containing only LDL, one containing only HDL2, one containing only HDL3, and one containing the remaining serum proteins.

After centrifugation, fractions were collected using a Beckman fraction recovery system. The purity of each fraction is checked using a Hewlett Packard HP1090 liquid chromatograph.

Light Beam Interaction Induced by a Transition Metal  
Complexed To A Tridentate Ligand

by

Christine M. Nelson

ABSTRACT

Transition metals when complexed with aromatic nitrogen donor ligands, such as 2,2'-bipyridine and 1,10-phenanthroline, exhibit very rich visible and near UV spectra. The multiple peaks are caused by the various transitions available to the electrons in the molecule, such as d to d, and ligand to ligand transitions and charge transfers between the metal and the ligand. The Schiff base derived from the condensation of 8-quinolinamine and pyridine-2-carboxaldehyde when complexed to a transition metal displays similar characteristics to other aromatic nitrogen donor ligands. A series of these Schiff base complexes, using different transition metals as the center, was synthesized. The samples were placed in orthogonally intersecting laser beams to investigate whether they demonstrated properties that would induce interaction between the beams.

ELECTROMAGNETIC WAVE PROPAGATION IN A  
ONE-DIMENSIONAL RANDOM MEDIUM

by

Julia Rennenkampff

ABSTRACT

Given a slab of a temporally dispersive medium whose dielectric constant and conductivity vary deterministically on a large scale and randomly on a small scale compared to the width of an incident electromagnetic pulse, we characterize the approximate autocorrelation function for the reflected signal at the surface of the medium.

Synchronization of the *Chlamydomonas reinhardtii* cell cycle through  
light-dark cycling for subsequent testing with infra red laser light in  
experiments concerning human night vision

by

Christine Ritter

**ABSTRACT**

Synchronization of *Chlamydomonas reinhardtii* strain 125N through light-dark cycling was attempted through a variety of means: 1) aerated liquid cultures, 2) agar plate cultures with a 5 ml liquid overlay, and 3) non-aerated liquid cultures. These were cycled through 12 hour light-12 hour dark intervals with 2) and 3) being cycled through 18 hour light -6 hour dark intervals as well. A set of cultures were grown under constant light as a control. The light cycled cultures did not double during the dark period or show strong cell size distribution peaks that are expected of synchronization.

# Application of Nonlinear Filters

to VEP Data

by

Harold Longbotham, Ph.D.  
Jim Roberts, Graduate Student

## Abstract

To date, data reduction of steady state VEP data has relied on properties of linear filters. While linear filters are useful in the frequency domain, the technique of noise reduction in analysis of VEP data relies on estimating an unknown constant signal imbedded in an unknown noise. The averager is used currently to estimate this constant signal.

It has been shown that if one assumes the noise is zero mean, white, and considers the nonlinear class of OS (order statistic) filters, the averager is not the optimal filter unless the noise is normally distributed. In this work we demonstrate that for the VEP data considered and the six OS filters used, there is one OS filter that is consistently better than the averager, one that is equivalent, and the averager is better than the other four. This indicates not only that new filtering techniques should be used, but also gives an indication as to the noise distribution.

ABSTRACTS  
WILFORD HALL MEDICAL CENTER

Three Selected Areas of Research in Endocrinology And Metabolism

by

Antoinne C. Able

ABSTRACT

Several projects were undertaken at Wilford Hall Medical Center during my appointment there as a UES Summer Graduate Student Fellow. First, our laboratory addressed chemistry of saliva exist in patients with endocrine and metabolic dysfunction. Seven (7) patient were seen and saliva call will be used in future studies. Secondly, two questionnaires have been designed to be used to assess the nutritional knowledge of diabetic patients. The 40 item questionnaire was designed by Registered Dieticians and will be used to validate the 48 item questionnaire designed by the facilities endocrinologists. Thirdly, the special chemistry laboratory sought to determine the reliability of a glycosylated hemoglobin assay kit.



Utility of Sensitive Immunoradiometric Assay (IRMA)  
to Predict Results of Thyroliberin Stimulation Test.

Stanley D. Adams

ABSTRACT

The clinical utility of two "sensitive" immunoradiometric assay (IRMA) kits (Tandem-R TSH HS, Hybritech, Inc; Echoclonal TSH, Bio-Rad) was evaluated in relation to analytic and clinical performance for measurement of thyrotropin (TSH). Their performance was compared to that of a "regular" IRMA (ARIA-HT, Becton-Dickinson) in order to learn whether these sensitive assays might be clinically useful to predict results of the thyroliberin (TRF) stimulation test, thereby obviating the need to perform this expensive and time-consuming test.

Suitable patients were identified who had had a TRF test previously and 107 refrigerated serum samples were located, along with pertinent records associated with these samples. The samples were provided to the laboratory for high-sensitivity assay, and a preliminary data file was created. Descriptive statistics were done on these data, and groundwork was done to expedite the accomplishment of inferential statistics.

Additional research assistance was provided to two other projects: a research paper was revised from an intermediate draft to final drafts and submitted to a scientific journal and an on-going cardiological research project was given off-line computerized left-ventricular pressure/radioactive count data analysis.

## DENTAL MATERIALS

by

Bobby L. Larry

### ABSTRACT

The shear bond strength of commercial liners and bases to prepared dentin was investigated. Two liners which contain calcium hydroxide and are polymerized by visible light, (Prisma VLC Dycal) and Cavalite (Kerr), were compared with a capsulated "Bonded-base" cement (ESPE Kefac-Bond applicap) and two glass ionomer lining cements: Shofu lining cement and GC lining cement. These materials were also used to determine the amount of fluoride released when used as a liner or base.

The strength of different types of pin-retained amalgams was investigated. Stainless steel pins: Stabilok small diameter, MPS, TMS minum, DENLOK, TMS Link Series (Whaledent) and one SS goldplated TMS Minum (Wholedent) were compared with 3 titanium pins; Filpin, Stabilok 6mm and TMS Link Plus.

In Vitro Culture of Human Keratinocytes  
with Subsequent Induction of Stratification

by

Aleshia C. Lewis

ABSTRACT

Human keratinocytes were cultured from cells obtained from newborn foreskin. The method used involves a two-phase technique that optimizes proliferation (Phase I) and differentiation (Phase II). Phase I consist of developing monolayers of highly proliferative basal cell-like keratinocytes in serum-free keratinocyte growth medium (KGM). Phase II involves the induction of differentiation and stratification of these confluent monolayers. The resulting epidermal sheets are removed from the medium and stained for specific keratinocyte cell markers (keratin, bullous pemphigoid, pemphigus vulgaris, and laminin) using immunofluorescent techniques.

Autologous Bone Marrow Transplant for Poor  
Prognosis Lymphomas- A Pilot Dose Escalation  
Study of a BACE Regimen and Follow-Up

by

John Y. Salinas

ABSTRACT

A pilot dose escalation study of autologous bone marrow transplant patients is currently in progress whereby the standard preparatory pre-transplant regimen of BACT established by the National Cancer Institute is being modified by substituting VP-16 Etoposide , for 6-thioguanine currently in use. VP-16 is a more active anti-lymphoma drug. The doses are sequentially being escalated in a patient population which is resistant to standard primary lines of treatment , with relapse of the aggressive lymphoma following a brief remission. The modified regimen , BACF , also involves escalation of BCNU and Ara-C. Initially all patients have been treated with 7 weeks of MACOP-B cytoreduction. Data has been extracted from medical files of already transfused patients. Methods of prospective data retrieval for specific parameters has been incorporated.

Kimberly Smith

ABDOMINAL ABSCESS FORMATION IN THE MOUSE MODEL

ABSTRACT

The purpose of this research project was to develop a reproducible model of intraabdominal abscess formation in mice. The sterilized cecal contents of twenty adult meat-fed Wistar rats were combined with a suspension of Bacteroides distasonis and Streptococcus faecalis and injected intraperitoneally into twenty juvenile C57/BL6 mice. The mice were allowed food and water on a continual basis for one week following injection and thereafter euthanized and examined for abdominal abscess formation.

ABSTRACT

The Diabetic Effects Assessment and Recording Scale (DEARS) was shown to be reliable and valid in a study involving 206 diabetic patients. We took patient responses from 130 of the same patients and had the responses coded and entered into a data bank. After the data was checked for accuracy, data from the DEARS and the Locus of Control for Diabetes were to be statistically analyzed using analysis of variance to obtain interpretable results. We hypothesized that lower scores on the DEARS should correlate with internalized scores on the LOC. The importance of these results will be to show further validation for the DEARS as a measurement instrument to assess comprehensive health status in diabetes.